RECYCLABLE MATERIALS SCIENCE AND TECHNOLOGY DEVELOPMENT ACT OF 1989

HEARING

BEFORE THE

SUBCOMMITTEE ON DEPARTMENT OPERATIONS,
RESEARCH, AND FOREIGN AGRICULTURE

OF THE

COMMITTEE ON AGRICULTURE
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

FIRST SESSION

ON

H.R. 500

NOVEMBER 16, 1989

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RECYCLABLE MATERIALS SCIENCE AND TECHNOLOGY DEVELOPMENT ACT OF 1989

THURSDAY, NOVEMBER 16, 1989

House of Representatives,
Subcommittee on Department Operations,
Research, and Foreign Agriculture,
Committee on Agriculture,
Washington, DC.

The subcommittee met, pursuant to notice, at 2:20 p.m., in room 1300, Longworth House Office Building, Hon. George E. Brown, Jr. (chairman of the subcommittee) presiding.

Present: Representatives Stenholm, Olin, Jontz, and Walsh.

Also present: Representative Hochbrueckner.

Staff present: Francie Monaghan, clerk; William A. Stiles, Jr., James A. Davis, John J. Aguirre, and Sondra Feldstein.

OPENING STATEMENT OF HON. GEORGE E. BROWN, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. Brown. The subcommittee will come to order. This afternoon, we are meeting to hear testimony on section 5 of H.R. 500, legislation introduced by our colleague, Mr. Hochbrueckner, which would expand USDA's efforts to develop solid waste composting technology.

The growing problem of solid waste management is much in the news these days, whether it is barges or railroad trains full of sewage sludge wandering about the Nation or the problem of land fills overflowing. It is obvious that we need to get a handle on this problem and develop new technologies which can help us.

Composting is one of those technologies, and one which is being used by many municipalities to reduce the volume of their solid waste and produce a useful product from that waste. But there are difficulties being experienced which need additional research and development work by State and Federal agencies.

Today, we are going to try to determine whether that investment needs to be made, and if so, what level of effort it is going to take.

Some of my colleagues from rural areas might not see the connection of today's hearings to the needs of rural towns. I think we all tend to see the solid waste problem as an urban problem. But small communities are also in need of waste treatment technologies, especially those that do not involve large capital investments. Also, rural areas are the ones who suffer when urban landfills overflow and urban areas export their garbage to rural areas.

Finally, the use of on-farm composting is a technology which might solve the animal waste problem. In a recent field hearing in Texas, we examined the problems posed by dairy waste to the water supplies in a rural Texas area near Dallas. Expanded composting might be one way to stabilize that waste and produce a commercial product that urban and suburban residents of Dallas would purchase.

We are looking forward to hearing from the witnesses this afternoon, and before I call on our first distinguished witness, I will ask if any of my colleagues have an opening statement they would like to make.

[H.R. 500 follows:]

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101st CONGRESS
1st Session

H. R. 500

To encourage scientific research and development of technologies relating to recycling, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

January 4, 1989

Mr. Hochbrueckner (for himself, Mr. Ackerman, Mr. Berman, Mr. Boehlert, Mrs. Boxer, Mr. Brown of California, Mr. Conyers, Mr. Dixon, Mr. Donnelly, Mr. Downey, Mr. Fazio, Mr. Fish, Mr. Frank, Mr. Gallo, Mr. Gejdenson, Mr. Gilman, Mr. Harris, Mr. Hayes of Illinois, Mr. Jontz, Mr. Mrazek, Mr. Morrison of Connecticut, Mr. Neal of North Carolina, Mr. Owens of New York, Ms. Pelosi, Mr. Roybal, Mr. Sabo, Mr. Saxton, Mr. Scheuer, Mr. Traficant, Mr. Vento and Mr. Weiss) introduced the following bill; which was referred jointly to the Committees on Science, Space, and Technology, Agriculture, Armed Services, and Energy and Commerce

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A BILL

To encourage scientific research and development of technologies relating to recycling, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Recyclable Materials Science and Technology Development Act of 1989".

SEC. 2. STUDY AND SCIENTIFIC RESEARCH REGARDING DEGRADABLE MATERIALS AND RECYCLING.

(a) IN GENERAL.—The Secretary shall conduct a study, including scientific research, regarding—

(1) available and potential degradable materials and possible methods for encouraging the increased use of such materials in manufactured goods;

(2) potential incentives for facilitating the development of new markets for recycled nondegradable materials, with an emphasis on nondegradable materials used in packaging;

(3) methods which may be used—

(A) to ensure development of technologies for recycling nondurable consumer products; and

(B) to ensure development of consumer products that are degradable in the marine environment; and

(4) the feasibility of requiring warning labels on products that are not subject to recycling to inform consumers about the shortage of landfill capacity.

(b) REPORTS.—Not later than 2 years after the date of the enactment of this Act, the Secretary shall transmit a report to the Congress—

(1) which describes the findings and conclusions of the research and studies required by this section; and

(2) which makes recommendations to Congress regarding—

(A) how to ensure the development of technologies for recycling nondurable consumer products;

(B) how to expand the marketing of recycled products; and

(C) how to ensure the development of consumer products that are degradable in the marine environment.

SEC. 3. STUDY AND RESEARCH REGARDING USE OF DEGRADABLE MATERIALS IN, AND FEASIBILITY OF RECYCLING OF, MEDICAL EQUIPMENT AND SUPPLIES.

(a) IN GENERAL.—The Secretary of Health and Human Services shall conduct a study, including scientific research, regarding—

(1) degradable materials which could be used in place of nondegradable materials currently used in medical equipment and supplies; and

(2) the feasibility of recycling nondegradable medical supplies.

(b) REPORT.—Not later than 2 years after the date of the enactment of this Act, the Secretary of Health and Human Services shall transmit a report to the Congress which describes the findings and conclusions of the study required by this section.

SEC. 4. STUDY OF NATIONAL SECURITY IMPLICATIONS OF USE OF DEGRADABLE MATERIALS AND COMPLIANCE WITH ACT.

(a) In General.—The Secretary of Defense shall conduct a study, including scientific research, regarding—

(1) the implications for national defense of requiring use of degradable materials in items procured by the Department of Defense; and

(2) the national security implications of requiring the Department of Defense to comply with section 7.

(b) Report.—Not later than 2 years after the date of the enactment of this Act, the Secretary of Defense shall transmit a report to the Congress which describes the findings and conclusions of the study required by this section.

SEC. 5. MUNICIPAL WASTE AND SEWAGE SLUDGE COMPOSTING PILOT PROJECT.

(a) In General.—Not later than 6 months after the date of the enactment of this Act, the Secretary of Agriculture shall initiate a pilot project to develop and demonstrate viable technology for the composting of municipal waste and sewage sludge.

(b) Project Requirements.—The pilot project carried out under this section shall include—

(1) composting of municipal garbage and other solid waste in combination with sewage sludge;

(2) separation and recovery of nondegradable materials from the resulting compost mixture;

(3) utilization of the finished compost for agricultural purposes; and

(4) utilization of the recovered nondegradable materials for construction materials and other purposes.

(c) Report.—The Secretary of Agriculture shall submit a report to the Congress not later than 1 year after the date of the enactment of this Act which describes the results of a project carried out under this section.

SEC. 6. OFFICE OF RECYCLING RESEARCH AND INFORMATION.

(a) Establishment.—Not later than 6 months after the date of the enactment of this Act, the Secretary, in consultation with the Administrator, shall appoint a Director of Recycling Research and Information, who shall be paid at a rate determined by the Secretary which is less than the rate of basic pay payable for positions under section 5316 of title 5, United States Code.

(b) Function.—The Director of Recycling Research and Information appointed pursuant to this section—

(1) shall make grants under subsection (c) to public and private entities to support research and de-

velopment by such entities relating to innovative recycling technology; and

(2) shall collect, catalog, and disseminate information to interested persons regarding waste disposal and recycling technology.

(c) GRANTS.—The Director of Recycling Research and Information shall make grants for studies and scientific research relating to recycling of nondegradable materials, including grants for—

(1) a study to determine the nondegradable products and materials which—

(A) are not currently recycled in significant amounts; and

(B) which are found in the largest amounts by volume and by weight in municipal solid waste streams;

(2) a study of which post-consumer nondegradable products and materials are best suited for recycling, and of ways to encourage industry to include recyclability as a basic design goal for the long-term resolution of the issue of recycling of nondegradable materials;

(3) scientific research into the development of recycling methods and systems for nondegradable materials, including collection, sorting, reclamation, and end-use manufacturing, which will improve energy conser-

vation through the preservation of the chemical energy content of recycled nondegradable waste products and materials; and

(4) an analysis of which nondegradable waste products and materials present potential environmental risks through current disposal pathways and of the role of recycling in reducing such risks, including an analysis of issues relating to biodegradable materials and the impact of nondegradable materials on marine life.

(d) OUTREACH PROGRAM.—

(1) IN GENERAL.—The Director of Recycling Research and Information, in consultation with the Administrator, the Secretary, and the Secretary of Education, shall conduct a 5-year public outreach program to provide information to secondary school students, State and local governments, and the general public regarding—

(A) the harmful effects on the environment of the improper disposal of wastes;

(B) the importance of the proper disposal of municipal wastes;

(C) the benefits of recycling; and

(D) methods to encourage voluntary recycling activities.

(2) FORMAT.—In conducting the outreach program described in paragraph (1), the Director of Recycling Research and Information may—

(A) organize and conduct workshops with interested groups;

(B) develop educational materials and provide them to secondary school students;

(C) record public service announcements for radio and television broadcast and develop print advertisements for newspapers, magazines, and other publications;

(D) distribute leaflets, posters, and other materials;

(E) encourage employers and labor organizations to include appropriate educational materials in their in-house publications; and

(F) provide technical assistance and other information to schools, governments, and community groups wishing to conduct educational programs on waste disposal and recycling.

(e) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Director of Recycling Research and Information appointed pursuant to this section, for making grants and carrying out other activities authorized by this section, not more than $10,000,000 for fiscal year 1990.

SEC. 7. PROHIBITION.

(a) IN GENERAL.—No person—

(1) shall produce, manufacture, distribute, sell, or deliver in a State any nonrecycled consumer good listed by the Secretary under section 8(b);

(2) shall distribute, sell, or deliver any food or beverage intended for immediate consumption, in any container composed of a material which is not photodegradable or biodegradable; or

(3) shall distribute, sell, deliver, or otherwise provide any regulated item which is made in whole or in part of a material which is not a naturally degradable material.

(b) PENALTY.—

(1) CIVIL PENALTY.—Any person who violates this section shall be subject to a civil penalty assessed by the Administrator of not more than $5,000 for each offense.

(2) CRIMINAL PENALTY.—Any person who knowingly violates this section shall be guilty of a misdemeanor and on conviction shall be fined under title 18, United States Code, imprisoned not more than one year, or both.

(c) DEFINITIONS.—In this section—

(1) REGULATED ITEM.—The term "regulated item" means any device which—

(A) is made, used, or designed for the purpose of packaging, transporting, or carrying multipackaged cans, bottles, or other containers, and which is of a size, shape, design, or type capable, when discarded, of entangling fish or wildlife; or

(B) is a form of secondary packaging (including a shopping bag) which is used for temporary containment and conveyance of other items distributed, sold, or delivered.

(2) NATURALLY DEGRADABLE MATERIAL.—The term "naturally degradable material" means a material which, when discarded, will be reduced to environmentally benign subunits under the action of normal environmental forces (including biological decomposition, photodegradation, and hydrolysis).

(d) EFFECTIVE DATE.—Subsections (a)(2) and (3) shall be effective on the date which is 2 years after the date of the enactment of this Act.

SEC. 8. DESIGNATION OF NONRECYCLED CONSUMER PRODUCTS, REGULATED ITEMS, AND NATURALLY DEGRADABLE MATERIALS.

(a) CONSUMER PRODUCTS DESIGNATION REGULATIONS.—

(1) ISSUANCE OF REGULATIONS.—Not later than 4 years after the date of the enactment of this Act, the Administrator and the Secretary shall jointly issue regulations which establish criteria and procedures under which the Secretary—

(A) shall designate items to be nonrecycled consumer goods for purposes of section 7;

(B) shall designate items to be regulated items for purposes of section 7; and

(C) shall designate materials to be naturally degradable materials for purposes of section 7.

(2) NONRECYCLED CONSUMER GOODS CRITERIA.—Criteria established in regulations issued under this subsection—

(A) shall require the designation of an item as a nonrecycled consumer good if—

(i) the item is manufactured or otherwise produced for commercial sale;

(ii)(I) the item has a limited useful life after final sale; or

(II) the item is used principally for the packaging or other temporary containment prior to final sale of another commercially produced item; and

(iii) less than 75 percent of all such items produced, manufactured, distributed, sold, or delivered in the United States each year are commonly remanufactured and resold or otherwise recycled; and

(B) shall provide for designation of a material as a naturally degradable material only if it is reduced to environmentally benign subunits within the shortest period of time that is consistent with the intended use of items which contain the material.

(b) LISTING OF ITEMS AND MATERIALS.—

(1) IN GENERAL.—Not later than 1 year after the date of the issuance of regulations under subsection (a), the Secretary shall issue and thereafter periodically update—

(A) a list of items which are designated by the Secretary under such regulations to be nonrecycled consumer goods;

(B) a list of items which are designated by the Secretary under such regulations to be regulated items; and

(C) a list of materials which are designated by the Secretary under such regulations to be naturally degradable materials.

(2) Exclusion from list.—The Secretary shall exclude an item from a list issued and updated under paragraph (1)(A)—

(A) with respect to production, manufacture, distribution, sale, and delivery of such item—

(i) for use as a medical supply; and

(ii) for use as packaging or other temporary containment prior to final sale of medicines and medical supplies;

(B) with respect to production, manufacture, distribution, sale, and delivery of such item for use for national defense purposes if the President, after consultation with the Secretary of Defense and the Administrator, certifies to the Secretary that inclusion of the item in the list would unreasonably harm national security; and

(C) if the Secretary determines—

(i) that it is not feasible to require recycling of the item; and

(ii) that it is not feasible to manufacture or otherwise produce the item or material in a biodegradable form.

SEC. 9. DEFINITIONS.

For the purposes of this Act—

(1) ADMINISTRATOR.—The term "Administrator" means the Administrator of the Environmental Protection Agency.

(2) SECRETARY.—The term "Secretary" means the Secretary of Commerce.

SEC. 10. EFFECTIVE DATE.

(a) IN GENERAL.—Except as provided in subsection (b), this Act shall be effective on the date of the enactment of this Act.

(b) PROHIBITIONS.—Section 7 shall be effective on the date which is 5 years after the date of the enactment of this Act.

○

OPENING STATEMENT OF HON. JIM JONTZ, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF INDIANA

Mr. JONTZ. Mr. Chairman, I might say very briefly that as a Representative of a very rural area, I certainly am concerned about this issue and appreciate the leadership of Congressman Hochbrueckner in bringing this bill to our committee, and also your thoughtful consideration in scheduling this hearing today.

I am certain that the issues being discussed today and maybe some answers we will hear this afternoon will be of interest to people in small towns that I represent just as well as the residents of major cities.

So, thank you very much for making this opportunity possible.

Mr. BROWN. Thank you, Mr. Jontz. Our first witness will be the author of the legislation, the Honorable George J. Hochbrueckner, a Member of Congress from New York, and I want to express my commendation to him publicly for the initiative he has taken in introducing this bill, which would go a long way toward solving the problem of solid waste, which is overflowing our country, today.

We will hear your statement, Mr. Hochbrueckner, and when you have completed it, and we have any questions we may have, we would like to invite you to come up and participate in the further proceedings if you would like to do so.

You may proceed with your statement.

STATEMENT OF HON. GEORGE J. HOCHBRUECKNER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. HOCHBRUECKNER. Thank you very much, Mr. Chairman. I thank you for the opportunity to be here today to speak about H.R. 500, the Recyclable Material Science and Technology Development Act. And I thank you for being a supporter and for playing an important role in moving this important legislation.

To date, it enjoys the partisan support of over 141 cosponsors. It deals with the major problem that we face in this Nation, which is the garbage problem.

We, in this Nation, are very wasteful. We produce close to a ton of waste per person per year. As you know, we were all surprised unhappily by the traveling of the Islip garbage barge over time around the world looking for a home to dispose of their garbage, which came from Long Island.

Coming from Long Island, New York, myself, I felt it was appropriate that since we sort of helped to raise this issue to international focus, that we should on Long Island be the source of a potential solution.

What I envision, based on my studies, is an overall hierarchy of how we deal with the waste problem. First, we need to take steps in order to minimize the amount of waste that we do produce. In dealing with what is there, I envision that the most appropriate way to handle it is first to maximize recycling, and then with what is left in the waste stream, to then maximize composting, and only then with what is left of the waste stream should we then move it into incineration or a land-filling mode.

We, at this point, recycle about 10 percent of our waste, and I think there is tremendous potential in composting. Now, the chart that I have up here indicates the average contents of a landfill, and of course on the back side I have the strategies under my bill, H.R. 500.

I think that as most people examine it, they will see that 37 percent of our waste stream is paper and paperboard, and certainly that is appropriate for recycling and composting. About 30 percent is food and yard waste, and that certainly is ideal for composting. Ten percent is glass. That is fairly standard technology to dispose of the glass. Ten percent is metals. Certainly, those should be recycled. Seven percent by weight are plastics, about 21 percent by volume. Plastics are a problem. And 6 percent is miscellaneous.

H.R. 500 is the most comprehensive bill that has been introduced in the Congress to deal with our waste problem. It involves a 5-year program, and I won't go into the details because much of it is concentrated on recycling. Some is involved with how do we deal with the plastics problem, but of course the purpose of today's hearing is to deal with the composting issue. So, let me deal with that.

Under H.R. 500, by month six after enactment, the USDA would start composting studies and projects, and within 1 year, they would report on composting.

Now, from a process point of view, my bill must travel through four committees. The House Armed Services Committee has already approved in this year's Defense Authorization Bill their portion of it because the military is a tremendous consumer of goods and a large producer of waste.

The Energy Commerce Committee has already had a hearing on the bill with those areas in their jurisdiction. The same is true with the Science, Space, and Technology Committee. They will be having another hearing. And of course, today's hearing on the Agriculture Committee side in section V.

And essentially what we are asking is this, that the Agriculture Department be involved and do a study of the various methods of composting so that we can outline in detail to the municipalities around our Nation the most appropriate ways to deal with the various elements in their waste stream, whether it is very sophisticated waste from computer papers and other processes that you might find in some areas to farm waste in others.

Of course, back in the 1970's, the Agriculture Department did some comprehensive studies that helped in terms of setting up the 100 sewage sludge plants that have been set up where sludge is utilized with composting. We would like to reawaken USDA and have them involved in this process to help us handle the waste stream.

We estimate that about one-third of all of the waste could be handled through the composting mode, and certainly it is an important route to go. Composting, as you know, is an ancient, but a very effective technique for handling waste. And the area that we would like to see looked at is how to directly compost solid waste, depending whether it is cardboard, or perhaps paper if we are not recycling it, to other areas of the waste stream.

We are also talking about looking at "cocomposting," where we would take trash along with sewage sludge, and combine those in a way where we could produce, in essence, a mulch that would be useful for horticulture, agriculture, and in other ways.

And so, I think this is an important route to go. I regard composting as the "sleeping giant" of waste management. I think it offers a tremendous opportunity for us to address the waste management issue and to do it in a way that produces a useful by-product which would be especially helpful in various areas of agriculture.

So, Mr. Chairman, I would like to submit my statement for the record. Obviously, I have not read from it. I have spoken off-the-cuff, but much of the things in greater detail that I have spoken about are in my statement, I will be happy to conclude my remarks.

I would be certainly pleased to answer any questions you may have, and then I would be delighted to join this panel and to listen to the other two panels of experts who can tell us about their views on composting.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Hochbrueckner appears at the conclusion of the hearing.]

Mr. **Brown**. Any questions from members of the committee? Mr. Olin.

Mr. **Olin**. Mr. Chairman, I just wanted to say that I want to thank the gentleman from Long Island for his contribution. I happen to be in a district where we are currently receiving 65 18-wheel trailer loads of garbage and other trash from several unnamed States up North each day, and we badly need to have some technical answers to that problem.

I think the gentleman has an excellent focus, and I will be certainly very happy to give whatever support I can to his legislation.

Thank you, Mr. Chairman.

Mr. **Brown**. Thank you.

Mr. Jontz.

Mr. **Hochbrueckner**. May I make just a quick response? I share your concern, and I am not proud to say that we, on Long Island, do in fact export and ship out more garbage than we do potatoes, wine, Long Island ducklings, and other excellent products that we produce on Long Island.

We would rather turn that trash around, keep it to ourselves, dispose of it properly and send you the best ducklings that you can ever buy.

Mr. **Olin**. Mr. Chairman, I would like to just indicate to the gentleman that I put him on notice because I got a provision which has been accepted by the committee that is going to be passing the reauthorization of RCRA, that deals with the hazardous and solid wastes, and it will set in motion a scheme under which States can qualify to make a determination as to whether they are going to either ship or accept anything from another State of this nature.

So, within a couple of years, it could be that the States can just say no, if they want to, and it is going to really put a lot of emphasis on finding a good, practical way of recycling waste of all types, which is really what we ought to be doing.

I thank the gentleman.

Mr. **Brown**. Mr. Jontz.

Mr. **Jontz**. Thank you, Mr. Chairman. I might quibble with the gentleman from New York as to whether the ducklings produced on Long Island are better than those produced in Indiana, but be that as it may, I think this proposal is very helpful, and I want to make sure I understand it properly.

The scope of section V of H.R. 500 would be to authorize USDA to carry forward to a research project to examine various technologies for composting solid waste and cocomposting. Is that a fair summary of what H.R. 500 would do with regard to composting?

Mr. HOCHBRUECKNER. That is correct.

Mr. JONTZ. It would require the studies?

Mr. HOCHBRUECKNER. Yes. We believe they are the experts, and we look to them to tell us the best way to handle the various components of the waste stream that would be appropriate for composting.

Mr. JONTZ. Thank you.

Mr. BROWN. Mr. Olin's comment about the possibility of States being able to refuse to accept garbage from other States leads me to comment on another development on the horizon, and it may take a little longer than 2 years, but it is not much longer than 5 or 10 years, and that is to establish rules and regulations that would prohibit the export of waste by any entity, including manufacturing entities and others.

They would become responsible for keeping all of the effluence from their processes within the confines of their own property or treating it in such a way as to be harmless in the environment.

There is a growing feeling that this may be the only way to deal with the increasing amount of effluence, which are going out into the common property; that is, the air, the water and the soil. And of course, that possibility, and I may be exaggerating the speed at which that will take place, but I think it is inevitable.

That possibility makes it even more important that we have processes such as we are describing here to help contain that kind of waste from a variety of different kinds of activities.

We have no further questions, Mr. Hochbrueckner, and you may come up here and join us, if you will.

Mr. HOCHBRUECKNER. Thank you, Mr. Chairman.

Mr. BROWN. Our next panel is Mr. Bruce Weddle, Acting Director, Municipal Solid Waste Program, EPA, accompanied by Mr. Bill Diamond, and Dr. Rufus Chaney, Research Economist, Ag Research Service, U.S. Department of Agriculture.

Would all of you gentlemen come to the table. First, Mr. Stenholm is recognized.

OPENING STATEMENT OF HON. CHARLES W. STENHOLM, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. STENHOLM. Mr. Chairman, thank you. I would just like to give a brief opening statement. From my perspective, it is very timely for our subcommittee to be holding this hearing on H.R. 500, Recyclable Material Science and Technology Development Act of 1989.

For some time, now, I have been hearing from a number of municipal and landfill officials, and that number includes every single one of my county judges and county commissioners, and that is 35, and every one of my 105 municipalities within my district, expressing their concern about their ability to meet the proposed EPA regulations governing the operation of landfills.

I am very interested in seeing how H.R. 500 might help these municipalities meet their obligations under the RCRA Act.

As you know, the EPA is in the process of evaluating the public response to the proposed regulations, and the final regulations will be released some time in early 1990. It is my understanding that the Texas Department of Health has reported virtually no change in the proposed regulations following over 3 months of negotiations.

I have been advised that no city under 50,000 in population could afford to operate under the new landfill regulations, and in States like Texas, the alternative was area/regional landfills. The distances between cities in west Texas precludes the consolidation of solid waste disposal sites.

Given their limited financial resources, small and isolated communities currently have no option other than to burn their waste, and yet the temporary EPA authorization for open burning at Texas landfills terminated August 31, 1989.

There aren't many options available to rural communities who want to be in compliance with the law, and whose depressed economies don't afford them the financial wherewithal to pursue costly options.

With regard to section V of H.R. 500, initiating a municipal waste and sewage sludge composting pilot project, I understand the composting techniques could be used to manage one-third of the Nation's municipal solid waste.

I think it is indeed important to look at the potential this technology holds for communities across the country. I am also very interested in learning more about the agricultural applications of composting and believe today's hearing could make a worthwhile contribution to the ongoing debate regarding solid waste disposal policy.

Thank you, Mr. Chairman.

Mr. BROWN. Thank you very much, Mr. Stenholm. Do you have an opening statement, Mr. Walsh, that you would like to make?

Mr. WALSH. No.

Mr. BROWN. All right, we will proceed with the testimony, then. Why don't you go ahead with your statement, Mr. Weddle, and then Dr. Chaney.

STATEMENT OF BRUCE WEDDLE, ACTING DIRECTOR, MUNICIPAL SOLID WASTE PROGRAM, OFFICE OF SOLID WASTE, U.S. ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY BILL DIAMOND, DIRECTOR, CRITERIA AND STANDARDS DIVISION, OFFICE OF WATER ENFORCEMENT AND PERMITS

Mr. WEDDLE. Thank you, Mr. Chairman. Good afternoon to you and other members of the subcommittee. My name is Bruce Weddle, and I am the Acting Director of the Municipal Solid Waste Program in the Office of Solid Waste, and with me is Mr. Bill Diamond, who is the Director of the Criteria and Standards Division in the Office of Water Enforcement and Permits.

Bill is here to help me answer questions that may relate to sewage sludge composting. My area of expertise is in the municipal solid waste area.

In the interest of time, I will summarize the written statement that I have already submitted. As we have heard from a number of the subcommittee members, local governments are facing serious solid waste disposal problems. Today, there are roughly 6,000 municipal solid waste landfills operating. And by the year 1992, I believe that number will be closer to 3,000 facilities.

At the same time, the amount of solid waste being generated is increasing, not only because the population increases, but because of increased generation rates on an individual basis. At the same time, siting of municipal landfills has become much more difficult. It is also true for incinerators and for recycling facilities and composting facilities.

In response to this situation, EPA issued its national municipal solid waste strategy in February of this year. It is called the "Solid Waste Dilemma: An Agenda for Action." This document establishes a hierarchy of solid waste management options. It prefers, first, that we not produce the amount of waste that we produce, that we reduce the amount of waste that we generate.

Following that is a preference for recycling. Recycling does include composting as a recycling technology. If, after recycling takes place, waste needs to be managed, that should be managed either by incineration with energy recovery or by landfilling.

This document also sets a national recycling goal of increasing the current rate of recycling from the current rate of 10 percent to 25 percent by the year 1992. In order to meet that goal, local governments will be establishing recycling programs for newsprint, glass, metals, and plastics, and we will see more emphasis on business recycling, much like the local District of Columbia law on office paper recycling.

However, in residential areas, recycling programs for newspaper, glass, metals, and plastics generally will achieve only 10 percent to as much as 18 percent recycling rates. In these cases, composting, as in other cases, will play an essential role. In particular, yard waste, which constitutes roughly 18 percent of the total waste stream, will be composted. Yard wastes are easy to collect, generally. It composts well, and there is little contamination problems in the final product.

Therefore, we in EPA see a dramatic growth in yard waste compost programs. Currently, we see roughly 800 to 1,000 yard waste compost programs. That will increase substantially over the next 5 years.

Cities are facing similar problems in disposing of their sewage sludge. By the year 2000, the amount of sewage sludge generated will double. The Nation's 15,000 treatment plants all face that problem of how to manage their waste.

Here, again, composting is a significant part of the answer. Today, roughly 9 percent of the sludge is used as a soil amendment in parks, on lawns, on golf courses, and in gardens. We expect to see this rate grow, and composting will be a key part in that growth.

In response to the expected growth of compost programs for both municipal solid waste and sludge, the agency has a number of programs underway already. In the municipal solid waste area, we have published case studies on yard waste of composting programs for local governments to help them decide whether and how to set up their programs.

We are studying markets for both mixed municipal compost and yard waste compost to determine whether or not there is a Federal role in stimulating those markets. That study is due late this winter.

We will be publishing a decisionmaker's guide on recycling in general, which will include composting, for city managers, mayors, and other local public officials to help them sort out the tough decisions they face in instituting recycling programs.

We will be publishing a guide book on composting yard waste and mixed municipal solid waste next spring. That will compare technologies. It will contain a list of things that local managers will consider in establishing yard waste and other compost programs. It will have information on costs.

And finally, we are just initiating composting guidelines this year. Those guidelines will focus on how to do composting. Things like odor control will be a major part of those guidelines. They will be very operational in nature.

In the sludge area, we work with USDA and a variety of universities over the past years to develop sludge composting technologies. We have studied the effect of composting on crops, on soils, and on the environment.

Recently, the Water Office published an evaluation of sludge composting systems, and we are developing further guidance for local government on how to evaluate, design, and operate sludge composting facilities.

Moving to section V of H.R. 500, EPA shares the view that composting is a key management technology for local governments to employ when dealing with municipal solid waste, yard waste, and sludge. Such programs will be both for all of those areas.

We believe that Government should focus its resources in the recycling area, however, on first the largest volume of waste constituents. Paper and paper board constitute roughly 41 percent of all municipal solid waste. The agency will be focusing resources on stimulating newspaper recycling as well as on commercial programs, office paper recycling programs, corrugated recycling programs.

Glass, metals, and plastic combined add up to 24 percent of the waste stream. The agency will be providing guidance to local government on implementing recycling programs for those commodities.

And yard waste, as I mentioned earlier, constitutes 18 percent of the waste stream, and as I mentioned, we will be developing information and assistance for local governments to institute composting programs for yard waste.

Therefore, we believe efforts in the compost area should be focused first on helping local government implement programs in those three general areas.

Therefore, for these reasons, we would give lower priority to programs that focus on composting mixed municipal solid wastes alone or mixed municipal solid wastes in sludge. However, that doesn't mean that we are ignoring those areas. As I mentioned, our market studies are looking at mixed municipal solid waste composting.

The guide book we will be developing, which will be available later this spring, is looking at mixed municipal solid waste composting, and we plan to evaluate the growing number of mixed municipal composting facilities that are coming on line now, both those that use sewage sludge with solid waste and those that are solid waste alone.

That concludes my oral statement, and Bill and I will be glad to answer any questions that you may have. Thank you.

[The prepared statement of Mr. Weddle appears at the conclusion of the hearing.]

Mr. BROWN. Thank you very much, Mr. Weddle. We will go ahead with Dr. Chaney, and then we will question all of you at the same time.

Dr. Chaney.

STATEMENT OF RUFUS L. CHANEY, RESEARCH AGRONOMIST, SOIL-MICROBIAL SYSTEMS LABORATORY, AGRICULTURAL RESEARCH SERVICE, U.S. DEPARTMENT OF AGRICULTURE, ACCOMPANIED BY W. DORAL KEMPER, NATIONAL PROGRAM STAFF

Mr. CHANEY. Thank you. Mr. Chairman and members of the committee, it is a pleasure to appear before you. I am Rufus L. Chaney, a Research Agronomist with the Agricultural Research Service, USDA. I am accompanied by Dr. Doral Kemper of our National Program Staff to help respond to questions, if needed. I worked on the subjects of the hearing since 1971, and have been trying to develop safe methods to utilize sewage sludge and sludge compost, both in the city and on the farm.

Congressman Hochbrueckner noted that we and our cooperators very successfully conducted research on composting sludge during the period 1972–82. This research was so successful that the private sector is developing marketable technology to compost sewage sludge. This is a competitive business with different companies offering different equipment for composting.

We are very happy to see our research transferred to the real world of the industry that solves municipal problems. Over 200 Publicly Owned Treatment Works—POTW—are using composting or nearly using composting.

An important question is why has sludge composting become accepted? We believe the acceptance was based on both the practicality of the sludge processing technology known as the Modified Beltsville Composting method, and on the basic research, which accompanied that composting research. This provided both a basis for Federal and State regulation of composting and marketing of sludge compost, and the specific recommendations for beneficial use of sludge compost. Sludge composting would have remained a scientific curiosity if the basis for sludge composting and for regulating sludge compost marketing had not been developed along with a method to make the compost.

This work involved many different aspects. It included stabilization of the compost, avoiding malodors, killing pathogens, fertilizer benefits, use in horticulture, use on farms, and at the end, we were beginning significant research on fate and effects of toxic organic compounds during composting and during utilization of the compost.

Results of this extensive research program provided a major part of the basis for development of State and Federal regulations, which facilitated sludge use while protecting the environment from misuse of sludge and sludge compost.

Identifying and developing bulking agents for sludge composting, and processes for cocomposting them with sewage sludge to provide the aeration and energy needed for composting and curing was a significant part of the ARS Beltsville Sludge related research during the 1970's.

Materials found suitable as bulking agents included wood chips, leaves, straw, other crop residues, and air-separated refuse. That is usually called RDF, or Refuse Derived Fuel. Certainly, the yard waste that Mr. Weddle talked about was included in that original research in the 1970's.

RDF, both pelletized and loose, was obtained from the demonstration separation facility in Cockeysville, Maryland. When sludge was mixed with RDF in appropriate proportions, it composted well.

Pelletized RDF was somewhat more successful as the bulking agent because the loose, nonpelletized material, mainly paper, tended to collapse upon wetting, and an additional bulking agent, such as wood chips, was needed to provide proper aeration during composting.

The difficulty with cocomposting separated refuse is not in the composting technology per se, but in producing a predictable beneficial product which will be accepted by horticultural and agricultural users.

The best means for separation and recovery of nondegradable materials resulting from the solid waste compost have been evaluated in pilot tests over the last few decades. In general, these tests have indicated the best approach involves preseparation, either at the curb, as EPA would recommend, or by the mechanical and high technology preseparation methodologies available, such as at Cockeysville. When the mixed solid waste is shredded, composted, and then separated, the compost product contains higher levels of metals and glass and is less acceptable to the user.

Research conducted on fate and effects of heavy metals and organics in sludge have provided information needed as guidelines for safe and successful solid-waste composting and cocomposting. If sludge is to be cocomposted with separated solid waste, research has shown that only sludge low in toxic constituents should be used. The higher the concentration of metals or toxic organics in the sludge, the higher the potential for food chain transfer or toxicity to plants. We should not allow more polluted sludge to be used with cocomposting. Pretreatment of industrial effluents provides clean sludge. This has been shown repeatedly.

The Department does not recommend enactment of section V of H.R. 500. Handling of sludge and refuse has traditionally been the responsibility of the Environmental Protection Agency within the Federal Government. However, several issues are considered in the bill, which are of interest to the Department of Agriculture.

I should note that in all this previous work, we cooperated with EPA. They have the authority and responsibility for sludge and refuse. We cooperated in research. Money was passed through either directly or through grant programs to cities, and that is how the work was done. It was never a directly-funded USDA research program on composting of sludge.

As noted, substantial research on sludge and refuse cocomposting was completed and has been published. However, we believe one significant impediment to adoption of this technology is the lack of adequate research results on cocompost utilization and benefits and safety information for regulation development for use in horticulture and agriculture.

Research on these questions cannot be completed in 1 year, partially because decomposition of compost, and release of nutrients and metals therefrom are slow processes, and we have to wait until they have occurred before we can report what happened.

The technology to optimize production of cocomposts and optimize their utilization have not been fully developed. Although, they were probably at the stage for final industrial development when we stopped studying sludge composting. It took more than a decade to provide the extensive national research data base about sewage sludge utilization, which now provides a basis for regulations and for public recommendations to growers. The 1-year reporting deadline proposed in the bill would not allow sufficient time to conduct research on cocomposting or on safe and beneficial cocompost utilization.

Such research is badly needed to develop guidelines to assure safe and optimal cocompost use, and to gain public acceptance and support of this potential major change in the way solid waste is managed in the United States.

Many publications have been prepared by USDA's Agricultural Research Service reporting research on composting, on sludge, and on sludge and compost utilization. Two are especially important to this subcommittee, the manual for Sludge Composting, and the bulletin for Sludge Compost Utilization, and copies have been provided to the committee. These documents communicate the results of research to users, be they EPA, States, cities, treatment works, companies that want to manufacture composting equipment or users of sludge compost. A list of publications from our research programs has also been provided to the committee.

Mr. Chairman, this completes my prepared statement, and I would be very happy to respond to questions.

[The prepared statement of Mr. Chaney appears at the conclusion of the hearing.]

Mr. Brown. Thank you very much, Dr. Chaney. A portion of the two publications you referred to will be placed in the record after your prepared statement. Mr. Stenholm, do you have any questions?

Mr. **Stenholm**. Mr. Weddle, was I correct in my opening statement expressing the concerns of the municipalities in my district concerning the rulemaking process that you are now under? Are we anticipating the proposed regulations to become final in early 1990?

Have there been virtually no changes in the proposed regulations, as you understand it, and therefore the problems that our folks are saying, that the regulations they see coming, they cannot afford to implement?

Mr. **Weddle**. Let me try a little bit circuitous answer at that. I actually was probably the person that your constituents referred to. I addressed the Texas Municipal League in Austin in September, and the message that I carried to the elected officials in Texas is that the rules will be published roughtly, in March 1990, they become effective 18 months later, and the regulations will require the cost of landfilling to go up.

There will be ground water monitoring at all landfill sites. There will be liners required in almost all landfills. While there will be a fair number of changes from the proposed rule, the impact on local governments, particularly small governments, will not change that dramatically. And therefore, the time is ripe now for rural communities to begin planning alternatives to the current open dumps that many of them are running.

A number of things you said in your opening statement were correct. Others were slightly incorrect, but I think the picture that you painted was fairly accurate.

Mr. **Stenholm**. If the picture is correct, then I am concerned. Did I understand you correctly, Dr. Chaney, that you oppose section V?

Mr. **Chaney**. First, we think that we cannot give you the information needed by the American people in 1 year. It is impossible.

Mr. **Stenholm**. I would agree to that.

Mr. **Chaney**. The information needs, we agree, are real. They are needed right now for the clean water 503 rules, which have been proposed by EPA. We need research results and theoretically marketing of cocompost would be handled under 503, and right now there are no Federal rules that allow cocompost marketing.

[Mr. Chaney's supplement statemental follows:]

Our position is that EPA has responsibility for solid waste, and USDA assists EPA by conducting research to provide needed scientific information.

Mr. **Stenholm**. That makes logical sense to me. Mr. Weddle, would you respond to Dr. Chaney's concern that if this is an area that has merit, and many believe it does, that we have this guillotine hanging over our cities and municipalities saying, "You're going to have to do something, but in the meantime, we can't really tell you what you ought to be doing because we have to get a little more time to do the research."

That suggests to them that additional study time is needed.

Mr. **Weddle**. There are, Mr. Congressman, many ways to skin the cat, and the message I was trying to carry in my testimony is that the area that we would prefer to attack first is to try to get recycling of bottles, cans, and newsprint, implemented as widely as possible.

We would like to see composting of yard waste, which is probably the easiest to collect, the easiest to compost, and has the least problems in terms of quality of the compost done as widely as possible.

We would like to see markets developed for yard waste compost as quickly as possible, and that the Federal dollar is best spent in those areas rather than following the suggestion in section V.

That doesn't mean that section V necessarily is a bad idea, but in terms of priority, I think there is a better way to get the job done, and the way I have outlined, provides solutions to a lot of the Nation's communities.

Mr. **Stenholm**. It is common sense, but I am afraid sometimes that we get lost in this because the goal is so honorable out there that we lose sight of some of the practical problems.

Mr. **Weddle**. Let me assure you that as part of the rulemaking, we are looking at that capability of local governments, and one of the areas that has not been decided yet, but which will go to the Administrator of the agency is providing relief to very small, remote, communities from the landfill regulations.

How we would do that and what we would relieve them of has yet to be determined, but it is getting serious top-level consideration.

Mr. **Stenholm**. I would say in conclusion, Mr. Chairman, that they have to understand that they cannot be exempted indefinitely from those processes that need to happen in order to maintain a clean and safer environment. They understand that and I hope will be willing to work with you on that.

Mr. **Brown**. I think, Mr. Weddle, that you said what Mr. Stenholm was listening for when you said that the small cities would be given a little more consideration.

We are going to have to recess for a few minutes. You can remain, I trust.

Mr. **Weddle**. Yes, I can.

Mr. **Brown**. We will be back in 10 minutes.

[Recess taken.]

Mr. **Brown**. The subcommittee will come to order. When we recessed, Mr. Stenholm had just finished.

Mr. Walsh.

Mr. **Walsh**. Thank you, Mr. Chairman, and thank you for holding this hearing today. This is an issue that is very important in up-State New York. It is obvious it is very important in down-State New York, due to Mr. Hochbrueckner's involvement.

There are those among my constituents, the more cynical ones, who think that now the Federal and State governments are moving to stop ocean dumping of sludge in the Atlantic Ocean, that my down-State neighbors are looking with dispersions about up-State land for a place to dispose of the sludge.

In fact, we, in central New York, have done some experimentation with land spreading of sludge ourselves. This is, as I said, a very important topic. I would like to ask a couple of questions of, first, Mr. Weddle, and that is, it is mentioned that there is a concern about heavy metals in sludge, and that is certainly a fact in Syracuse in the sludge that comes out of our wastewater treatment.

Are there standards that EPA considers acceptable in the levels of heavy metals that would be allowed in land spreading?

Mr. **Diamond.** I will answer that, Mr. Congressman. We have proposed in our regulations this past February numerical standards for up to 28 different specific pollutants, a number of them heavy metals and some pesticides, that would set explicit limits on land-applied sludge for pollutants.

Mr. **Walsh.** In the process of doing that, have you found that those heavy metals—as land spreading continues on the same parcel of land, that they are accumulative in effect?

Mr. **Diamond.** The way that we have set them is for heavy metals. We set accumulative loading rates per parcel of land. For the organic chemicals, we set them on an annual basis.

Mr. **Walsh.** Is there a way, technologically, to remove those heavy metals?

Mr. **Diamond.** No, not when they are in the soil.

Mr. **Walsh.** There is no way to remove them?

Mr. **Diamond.** There is no economically feasible way that we have now to remove them once they are in the soil, which is why we try to regulate them at the source.

Mr. **Walsh.** Does composting affect the concentration of heavy metals?

Mr. **Diamond.** No. Once it is in the sludge, it is very hard to remove. Composting does not affect it, which is why we emphasize things like source reduction or pretreatment of waste before it goes into the wastewater.

Mr. **Walsh.** So, if there was a consistent level of heavy metals—lead, zinc, cadmium, et cetera—found in municipal solid waste sludge, it would not be allowable for use for land spreading.

Mr. **Diamond.** Well, it depends on what the level is.

Mr. **Walsh.** Well, if it exceeded your requirements.

Mr. **Diamond.** If it exceeded our requirements, it could not exceed the cumulative loading rate we have in our proposal.

Mr. **Walsh.** What if a program was begun in a municipality to begin that, and after 1½ years of this process, they found that levels were consistently higher than what they initially found? Would it be cut off at that point?

Mr. **Diamond.** The proposal accounts for annual, monthly, quarterly monitoring of the sewage sludge product to determine what the quality is. If at any time it changes, then the accumulative loading rate would be adjusted accordingly.

Mr. **Walsh.** In New York State, the EEC, I believe, in our State law, would prevent the cows grazing or the livestock grazing or the use of perhaps any land that was subject to land spreading of sludge. Does that make sense to you?

Mr. **Diamond.** We have looked at a number of different environmental pathways, including grazing animals as an end-point to set our limitations, and therefore we have set them on the most restrictive basis where you have a potential impact.

In some cases, we do restrict grazing, for instance, primarily because of our pathogen uptake and that type of thing. If a restriction like that goes into place, then we have a separate type of regulation which would come into effect.

Mr. WALSH. How about the liability aspect of this? There are private businesses that do this, that provide the service to municipalities, but one of the problems is the farmers have to sign an agreement that if any harm comes from this—I am not sure exactly what the contract says, but the problem lies with the liability. Who is liable if someone is poisoned or hurt in some way from use of a product grown on this land that has been spread with sludge?

Do you deal with liability?

Mr. DIAMOND. In the Clean Water Act, section 405, which is our authority, they give us authority to regulate the entire chain of control there, whether it is POTW or distributor or the end-user.

To make it administratively feasible, we are trying to focus on the POTW, and they have to be in compliance with our regulations. The end-user would also have to have contractual agreement and comply with the regulations. For instance, if it says you can only put down 40 tons per acre, he could not exceed that or it would be a violation of the Clean Water Act.

Mr. WALSH. One last question, Mr. Chairman, and that is for my county's director of municipal solid waste, could you give me the name and telephone number of a contact that he could deal with to get these sorts of questions answered because we are in the midst of decisions on this.

Mr. DIAMOND. He could call my office and talk to Dr. Allen Rubin, who is the director of my sludge branch. He can be reached at (202) 475-7301.

Mr. WALSH. Thank you very much. I have no further questions.

Mr. BROWN. Mr. Jontz.

Mr. JONTZ. Thank you, Mr. Chairman. Dr. Chaney, if I understand your testimony correctly, you have no objections to the purpose of section V in establishing a pilot project to develop and demonstrate viable technology, the composting of municipal waste and sewage sludge. You just don't believe the USDA should do it. Is that correct?

Mr. CHANEY. Specifically, we think that the responsibility for all aspects of regulation and management of national programs to handle sludge and municipal solid waste refuse have been the responsibility of EPA, not USDA.

They even regulate animal waste disposal, although we certainly advise farmers about that. Otherwise, your statement was very correct.

Mr. JONTZ. Well, one of the benefits of the bill, as it was filed giving you the responsibility, was to get it within the jurisdiction of the Agriculture Committee so we could hold this hearing today and discuss the matter, but I won't dispute the point in terms of whose responsibility it has been traditionally vested in.

If I follow where you are going in your testimony from that point, you do see some other items which your Department is interested in, one being the impediment to adoption of technology based on the lack of research results on cocompost utilization and benefits in horticulture and agriculture.

Would it be helpful if H.R. 500 gave you some responsibility to conduct such research on utilization and benefits and horticulture and agriculture? Would you support such a provision were it to be added to H.R. 500?

Mr. CHANEY. I am caught here on exact words. The problem is, again, that it is EPA's responsibility on all these things. Certainly, they have only been able to obtain the research by working with the agricultural research community, the U.S. Department of Agriculture, and the Extension Service in the States.

So, yes, the research is badly needed. The work will never be done unless funds are appropriated for it. They have been put off 8 years already and are needed badly now, needed for the rule that has been proposed, et cetera.

If you can find a way to initiate that kind of program again so this research is available for sludge and cocompost so we can have these programs be solutions to national problems, that would be wonderful.

So, we are saying don't tell the USDA directly to do it because that is not the way that you have done it in the past. Rather this other traditional pathway is recommended for your consideration.

Mr. JONTZ. So, you believe that this research should be done with regard to utilization and benefits in horticulture and agriculture as well as information on protection of the environment in the food chain during cocompost utilization. Those are all necessary components of a research program, which you have the capability of doing, but which ought to be funded through EPA. Is that correct?

Mr. CHANEY. Funded through EPA, which supports both USDA research programs and State university research programs.

Mr. JONTZ. So, Mr. Weddle, do you support that?

Mr. WEDDLE. As I said before, there are several ways you can approach the problem. Right now, the agency is approaching it looking at recycling commodities, first. We use the paper to make more paper, not to make compost.

Mr. JONTZ. I heard you say that, but Dr. Chaney believes that this is very important research.

Mr. WEDDLE. The agency is not opposed to the research itself. It is saying that in the priority of things, the agency should be focussing its attention first on recycling of commodities and yard waste composting.

And then after that, if the Federal budget allows for that, the kind of research he has talked about certainly would be appropriate. It is not research that is not worthy of being done. It is first things first.

Mr. JONTZ. Well, this first things first argument has been used a long time to put off a lot of things that ought to be done.

Dr. Chaney, how much would this research cost? Is this comparable to, say, the research being conducted on Star Wars, or is this some more modest program?

Mr. CHANEY. Thank you for the set-up. During the whole time we did the sludge composting research, the total cost of scientists, space, technicians, everything was never more than a couple of million dollars a year.

When we were doing a full-blown demonstration program, the in-house resources were on the order of $600,000 to $800,000 per year, and the outside resources went as high as $1 million or as low as $300,000. Those are approximate numbers.

To do the multiyear work that is needed for this, which is seriously underresearched for making regulations, you have to look at a number of years in the program.

It has been a problem before, that money is available for 1 or 2 years, and you can't get the job done in that time.

Mr. JONTZ. Yes.

Mr. CHANEY. And, so, if you find a way to do this, I would recommend you consider that it has to be a long-term program, not a 1-year shot.

Mr. JONTZ. I appreciate that, but what you are telling us is a couple million dollars a year over several years would be adequate to fulfill the needs that you identify. Is that correct?

Mr. CHANEY. I wouldn't want to say less than 5 years because I know that there are problems that are awaiting solutions.

Mr. JONTZ. OK, a couple of million dollars a year for 5 years would probably meet the needs. Now, when you say utilization and benefits in horticulture and agriculture, are you also speaking about evaluating markets for compost products, market research or even generating markets?

There, we are getting into a little bit of a different phase of it. Whose job should it be to evaluate and generate markets for compost products? Should that be USDA's role or what?

Mr. CHANEY. In the early stages of, for instance, sludge compost product market development, USDA did research. We did it with Maryland Environmental Service, States, and State universities. We did that research because there was no market. We developed markets for use on lawns, use in revegetation, farmland, et cetera, by conducting research.

In the same way, although there are some markets for cocompost, making it so that people want to pay money for it instead of taking it off your hands if you pay them. Developing a scientific basis for markets would make a lot of difference in whether this is a successful program. Right now, there are not a lot of people demanding a compost from refuse plus sludge. Further, very few States have permit programs to allow marketing. It is not currently regulated by the Feds, although that is part of the 503 regulations that were mentioned by EPA.

Mr. JONTZ. OK. Let me ask you just one additional question, if I could, Dr. Chaney. I may have missed this in your testimony.

Did you address the issue of composting as an on-farm waste management practice?

Mr. CHANEY. I did not address that because that was not part of our original charge, I thought.

Managing the on-farm waste, crop residues, and animal manures, by composting, has been adopted by a very small number of farms. It is becoming of greater interest as a way to make money. Farmers who are taking organic wastes from the food processing industry and mixing it with some of their own crop residues are making as much money as they got for growing crops by handling sludge or industrial organic waste on the farm. That is becoming a significant on-farm, nontraditional farm income and solves some national problems. The need for composting animal waste or crop residues is a small need for direct farm interest, but a much bigger interest for nonfarm waste that might be used on farms or cocomposted with crop residues. So, there is great opportunity there. It is becoming a new money-making activity for farmers near to industry, the food processing industry, and so on. This is new. I hadn't heard about this 5 years ago, but it is going on, now.

Mr. **Jontz**. Mr. Chairman, I think that completes my questions and yield back the balance of my time.

Mr. **Brown**. Thank you, Mr. Jontz. Dr. Chaney, I think we understand quite well on this committee the pressures on the ag research budget and the need to prioritize expenditures.

Currently, the Department is proposing—and I don't know what the status of it is—a new ag research initiative, which would add a substantial amount of money to the ag research budget.

Do you happen to know if that initiative is broad enough to encompass a few bucks for this kind of thing as another end-user product for agriculture? Either of you can answer that.

Mr. **Kemper**. I do not remember seeing in that initiative a specific item covering the cocomposting aspect of waste handling. That, I suppose, we should look at, but I haven't looked at all of the drafts of that initiative.

Mr. **Brown**. Well, as I recall it, and it is very roughly there were six major areas in which they were proposing additional research, and of course, getting down to cocomposting is a rather fine detail compared with those six major areas.

I wouldn't expect to see it. I was just wanting your opinion as to whether the proposal might be broad enough to cover that kind of research if the administration does adopt it and provides the additional funding requested.

Mr. **Kemper**. I have a feeling that you could stretch that overall umbrella to cover this. Since it is being set up for competitive grants distribution, the question then comes up would you achieve the objectives that you desire within the time period that you need to achieve them because competitive grants generally are not as well controlled as more directed funds.

Mr. **Brown**. Well, we are not going to get into that argument, but there is nothing in the initiative, as far as I know, that would keep the land-grant colleges or even the ARS from receiving a competitive award for whatever research is necessary.

Mr. Weddle, of course—and the agency is fully aware of the importance of this problem of waste disposal—you have said on page 2 that you have issued a national strategy called the Solid Waste Dilemma: An Agenda for Action, which presents a strategy for improving the Nation's management of municipal solid waste.

Could you provide the committee with a copy of that?

Mr. **Weddle**. Yes, I have one with me. I will leave it at the conclusion of the testimony.

Mr. **Brown**. All right, and basically the agenda proposes integrated waste management as the key to resolving the dilemma. Actually, this is what Mr. Hochbrueckner's bill proposes, essentially an integrated scheme for handling this problem, including the items that you mentioned here, source reduction, recycling, and so forth.

You also state that EPA has a policy that actively promotes the beneficial use of sewage sludge, and that is published in the Federal Register. I guess we can get a copy of that. I would like to see it.

And, you have a booklet entitled "EPA's Policy Promoting the Beneficial Use of Sewage Sludge." A portion of both publications will be placed in the record after your prepared statement. It is clear that EPA understands the seriousness of the problem and is trying to solve it. Do you think your activities are meeting the need?

Mr. WEDDLE. I am in my current position now for 1 year. Before that, I worked on hazardous waste regulations, and one of the things that struck me personally working in this area is the unusual amount of positive feedback that I receive from local elected officials about the fact that EPA is now back into the municipal recycling area, that the documents we are producing are the kind of things that they need.

I think it is fairly rare for EPA to hear nice things. Usually, when we do something, everyone dislikes it, and that is the measure of success in EPA. If anyone likes it, there is something wrong. If everyone dislikes it, you have done it just right.

So, I think that yes, we are going a long way toward meeting the need, and we will continue to expand our program in the recycling area.

Mr. BROWN. And yet, the problem is getting worse very rapidly.

Mr. WEDDLE. I am afraid the problem is going to continue to get worse. The pressures are going to increase on local government. The decisions are going to get much harder over the coming years, and that is one of the reasons why the recycling work that we are trying to develop nationally is so important because it provides a positive solution to a problem.

Mr. BROWN. Well, I am not trying to be critical of EPA here because it is not only in the solid waste area that you have environmental problems. We are not solving the air pollution problem. We are not solving the acid rain problem, global warming problem.

In most of these cases, I think the EPA is out front trying to get a more aggressive program, and in some cases there are problems in getting the agreement within the administration as a whole and in many cases there is a problem getting the Congress to either agree to or to adequately fund the programs that are necessary.

So, I am not trying to pick on you. I am just trying to figure out where is the magic key that we can turn that would do something in this specific case about solid waste? You have developed a national strategy, but there is no teeth in it, as far as I can tell. You have put this out. It is a good program. It is being enthusiastically accepted, but nobody has to do anything about it unless they want to.

Is that a correct description?

Mr. WEDDLE. There is no hammer or enforcement provisions, but frankly, I do see a lot of things happening because local elected officials have to solve the problem. And they recognize that the solutions to the problem is not in Washington. It is in their own hands, and the information we are providing helps them.

Of course, they would like to see a big Federal grant program to pay for the solutions to their problems. But, I think the solutions are occurring, that for every ton of waste that I recycle, that is a ton I don't have to pay to land dispose. It extends the life of my landfill.

So, there are a lot of real world incentives for local elected officials to solve the problems, and they are doing that now. There is a lot to be done. I don't want to sound like a "Pollyanna" because the problem is serious, but I think we are moving in the right direction.

Mr. **Brown**. Well, my impression is it is not described as moving in the right direction, but not moving in the wrong direction quite as fast as we used to, and I am not sure that that is going to be good enough. It is better than what we were doing, but it still may not be good enough.

All right, I won't belabor you further on this matter, but we do appreciate your testimony, and look forward to continuing to work with you on this problem.

Our last panel this afternoon is Ms. Nora Goldstein, executive editor of Biocycle Journal, Mr. N.C. Vasuki, general manager of the Delaware Reclamation Project, and Mr. Michael Simpson, consultant, Energy System Research Group in Boston.

We recognize that you have come some distance to appear here. We appreciate it very much, and we will try and get you through here as quickly as possible. Would you be kind enough to start, Ms. Goldstein.

STATEMENT OF NORA GOLDSTEIN, EXECUTIVE EDITOR, BIOCYCLE MAGAZINE

Ms. **Goldstein**. Thank you very much for the opportunity to provide testimony today on section V of H.R. 500. I am Nora Goldstein. I am the executive editor of Biocycle Journal, which is a journal of waste recycling that has been published since 1986 originally under the name Compost Science.

I was asked by the committee to provide comments on several different areas, one being the current status of composting in the United States, the second being the views on the future of composting, and the third being a review of section V and the recommendations we have.

Just to talk about the status of composting, we conduct annual surveys of composting projects in the United States. We do one on solid waste composting. We do another one on sewage sludge composting, and a third on the yard waste composting, and I will just quickly—in the written testimony, we provided a listing of these projects, and I will just quickly give the numbers.

For this year, we found 75 in the area of solid waste composting, 75 projects from various phases of development. There are seven full-scale operating projects, and there are two others in construction and four about to go into construction.

Of those 75, 20 at this time include or plan to include sewage sludge or septage so they would be cocomposting projects. There are also five pilot projects either underway or about to get underway, and of those five, four do include solid waste composting. Four do include sewage sludge, and so they also would be a pilot cocomposting projects.

In sludge cocomposting, our 1989 data are not in yet, but last year we found 219 projects in various phases, 115 operating facilities, and we are just completing this year's survey and expect to see that same number of projects, and in fact a little bit more.

Just to note, the aerated static composting method, which was pioneered in the 1970's by the USDA research, is the most widely used system at this time for composting sewage sludge.

Yard waste composting, Mr. Weddle did give some numbers. Our data last year showed 650 yard waste composting projects operating, and we expect within the next 5 years to see that jump up to several thousand projects, and that will be fueled in large part by State bans on landfilling yard waste.

With regard to risks and benefits of composting, there is composting like all waste management options has limitations, and I would just like to go through the four we see. One is the review of risks and benefits.

The first is with regard to quality of the compost product. In theory, a major benefit of composting besides stabilization of the waste in volume reduction is that the process seals the valuable end product, but that value is directly affected by the quality of the solid waste in the sludge to be composted in the management of the composting process.

And some facilities only plan to compost solid waste as a method of reducing volume, and therefore there is little consideration given to the quality of the end product. But, the majority of the facilities do target higher end-usage for the finished compost, such as landscaping, horticultural markets, public works applications, and agricultural applications.

And in these cases, quality of the end product is critical in a determining factor on how the composting facility is designed and operated, and problems can occur when quality does not meet the demand of the market.

The second risk is the area of contaminants, and that has been addressed by the first panel. Quickly, the composition of the NSC stream is such that there is great potential for contamination both physical from glass, plastics, and metals, and chemical from various toxins in the waste stream.

The technology does exist to remove physical contaminants, and there is a good potential of having a fairly clean feed stock going into the solid waste composting facility.

With regard to chemical contaminants, many facilities or ones in the planning stage are utilizing household hazardous waste collection programs combined with education of citizens and businesses to try to keep these materials out of the waste stream.

Sewage sludge can have unacceptable limits of pollutants and, as was mentioned earlier, pretreatment is the best-known available method at this time for controlling those pollutants. And also, there has been a great deal of research on the fate of these pollutants when sludge is beneficially used.

So, in short, we believe it is possible to minimize risk, and regulations do play a big role in helping to minimize that risk.

The third area is in the area of process control, and I am bringing this up just to point out that composting is unique in the sense that success of composting does revolve around management of a biological process.

In the research that the USDA did in Beltsville as well as other places all greatly contributed to outlining principals and necessary procedures and process controls for composting. The lack of research on composting solid waste, especially with sewage sludge, has meant that these principals are not being further developed and enhanced as is needed.

The fourth area I outlined as far as risks and benefits is at this time, we believe that solid waste composting, the technology is being vendor-driven. There are 30 vendor systems in the marketplace. They are all aggressively marketing their technologies.

The upside is there is a wide variety of options available. The down-side and the risk is that vendors' eagerness to get projects up and running is driving the development of many projects.

On the one hand, having operating projects provides an opportunity to learn, but it is difficult to obtain independent scientific analyses of these projects and to critically examine the various approaches to the composting.

Again, the research conducted on sludge composting by USDA helped to create an independent body of knowledge that wastewater treatment plant operators used designed projects. In this generation of interest in solid waste composting, there is a need for that type of information.

With regard to the future of composting, I am just going to quickly list the trends. They are further described in the written testimony, that these are trends that are creating a positive environment for cocomposting projects. These include diminishing or nonexistent landfill capacity, anti-incineration sentiments, State policies that encourage composting, cost competitiveness of composting with other options, compatibility of composting with recycling programs, and an integrated waste management system, tighter landfill regulations that will force landfills to close, particularly in rural areas, and given markets for energy, and in small population base, composting is rapidly becoming the most viable alternative.

Also, efforts by States to protect ground water have been leading to tighter landfill restrictions and encouragement of sustainable farming practices, and all this does help to create a market for compost.

Finally, a development of agricultural land has been forcing wastewater treatment plants that traditionally have been using land application as sludge. They are loosing that outlet, and in that case, many facilities have to turn to other options, including composting.

I do want to mention that as far as the future goes, there is one possible black cloud on the horizon for composting, and that is EPA's proposed part 503 technical regulations for sludge management. As proposed, this rule would make if difficult for beneficial use programs to operate, including any that would cocompost MSW and sewage sludge.

The comment period ended in August, and there were many constructive comments on how to improve this regulation, and it is our hope that these comments will be incorporated into the final rule.

With regard to specific comments on section V, Biocycle encourages the involvement, once again, of USDA in composting research.

Since 1982, when USDA halted its involvement, the interest in composting MSW and sewage sludge has grown immensely.

The timing for USDA's involvement cannot be better, and the need for this kind of independent research is critical.

Quickly, some specific comments. This has been raised already, with regard to the timeframe. We also agree that 1 year is not adequate to gain the kind of information. However, if funding is only available for 1 year, we might suggest that USDA try to coordinate with some of these pilot projects that are either ongoing or are about to start, and perhaps focus on several aspects of the research, for example end-product analyses and research on applications of the compost.

Another part of the section V discusses separation of nondegradable materials from the resulting compost mixture. We believe it is much more practical and less risky from an end product quality standpoint to recover these materials on the front end of the system prior to composting.

Third, with regard to agricultural uses, we strongly encourage USDA to research agricultural applications for cocomposting products. Today, primary markets for sludge compost are horticultural, landscaping public works, not agriculture, and we believe there is a need for agricultural utilization of compost, and USDA research could be very beneficial in this area.

Finally, I just want to reemphasize that composting research outlined in section V is timely and needed, and it is important to emphasize that USDA's contribution to the development of composting cannot be stated strongly enough. It gave—this is with regard to the sludge composting research back in the 1970's—it gave wastewater treatment plant operators a package of information. They used to get sludge composting projects underway.

And clearly, USDA's involvement in cocomposting research will help to provide that kind of information; again, contributing to further development of composting in the United States.

Thank you.

[The prepared statement of Ms. Goldstein appears at the conclusion of the hearing.]

Mr. BROWN. Thank you very much. That was an excellent statement, Ms. Goldstein.

Ms. GOLDSTEIN. Thank you.

Mr. BROWN. Mr. Vasuki.

STATEMENT OF N.C. VASUKI, GENERAL MANAGER, DELAWARE SOLID WASTE AUTHORITY

Mr. VASUKI. Thank you very much, Mr. Chairman. We appreciate this opportunity to come before you. I am speaking with a certain amount of experience. My group is responsible for disposing approximately 850,000 tons of solid waste and about 65,000 tons of sewage sludge every year. And, so we are submitting this with a certain amount of hands-on experience.

Mr. Chairman, the biggest problem we see is not in making compost. We can produce enormous quantities of compost. We don't need further assistance for that. There is plenty of technology available, and making compost is not the difficult part. What do you do with the compost becomes the most difficult part.

As each community starts developing these yard waste composting programs, sludge composting programs, solid waste composting programs, we will be up to our ears in compost and not know what to do with it.

And as these compost piles build up in and around the country, we are going to have a different type of an environmental problem, probably odor, run-off.

So, Mr. Chairman, I think USDA's involvement in market development is essential, and the Federal involvement in setting standards for utilization is essential because if we don't have Federal standards for utilizing compost, we are not going to sell the compost or give away the compost.

I have some specific suggestions. For example, the U.S. Department of Transportation could require use of compost in all highway projects as a priority matter rather than stripping top soil from farm lands for revegetating highway projects.

Another specific example I can suggest is if Congress can give certain amounts of protection for use of compost on the Superfund sites when they are revegetated, an enormous quantity of compost can be used for that purpose.

Right now, there is a big concern about it. If we sell compost to a Superfund cleanup site and that site should leak sometime in the future, the question is whether we become a potentially responsible party. If there is some congressional guidance given on that, we can develop a market in that area.

EPA plays a very important role, and I am sorry that the agency has just not been able to come up with the standards. They have been at this for years and years, and we have been waiting for these Federal standards. Without the Federal standards, each State will set up an invisible barrier for movement of the compost. And when you have those invisible barriers, you have to dispose of the compost within your own area.

And my fear is that after a few years of composting, all of the compost will end up on the landfill anyway. That is defeating the whole point of composting.

As far as a Federal pilot program, we don't see the need for it because the Federal Government has already invested a lot of money in developing technology for composting. Our project at Wilmington is a prime example of that. We received over $37 million in Federal funding for that cocomposting project.

It is currently the largest cocomposting plant in the world. We produce about 35,000 to 40,000 tons of compost from that plant. We have been able to sell only 4,000 or 5,000 tons a year because only this year we received permission to sell it in the open market.

We can cooperate with the Federal agencies and the U.S. Department of Agriculture in some of the compost research, so there is no need for money for developing new composting processes.

I strongly urge you, Mr. Chairman, to look at compost utilization because without the market development, we are going to end up with a whole bunch of compost heaps.

Thank you, sir.

[The prepared statement of Mr. Vasuki appears at the conclusion of the hearing.]

Mr. **Brown**. Thank you very much, Mr. Vasuki. Your suggestions are excellent, and I think we may want to follow up on them.

Our last witness is Mr. Simpson.

STATEMENT OF MICHAEL H. SIMPSON, ENVIRONMENTAL SENIOR SCIENTIST, ENERGY SYSTEMS RESEARCH GROUP

Mr. **Simpson**. Thank you very much, Mr. Chairman. My comments will supplement my written testimony that is already submitted, and in some respects I will just be emphasizing things that have been said by my learned colleagues at this table since I think we are in like mind about this issue.

"Integrated Waste Management" has been a term thrown around—solid waste management—for a long time, and no one really defines it except through the agenda for action the EPA has come up, which they actually had the in 1970's.

Another definition is basically do not treat the waste stream as a homogenous mass, but treat each part in the most economic and environmentally sound manner. And moving toward municipal solid waste, we may not be moving far enough toward integrated waste management when we talk about municipal solid waste composting.

Composting has come to take its place as a viable alternative to handling fractions of the waste stream, even though the Federal Government is sort of regearing up. There are a number of State programs already in line that have investigated composting in a lot of different fields. There is a lot of information and research data and projects up that could provide EPA and USDA a good deal of information that would keep them from having to spend too long researching possible solutions.

There are certain restraints that I think are critical that I need to emphasize. I will just echo Mr. Vasuki, compost must be utilized before you can use composting as a solid waste management tool. If you don't find markets for it or you don't find end-uses for it, the long-term success of composting as an alternative for waste diversion will not last.

As such, we need to deal with the toxicity issue, both heavy metals and toxic organics. EPA, while they were here, quickly brushed over what I think is sort of the primary emphasis along this line, and that is source reduction, household hazardous waste, collection, and removal from the waste stream and industrial pretreatment.

If we are going to take mixed waste stream, we might as well take the materials out that are going to make it hazardous or dangerous to the public health and the environment, and that is true of integrated waste management, taking the material out and disposing of it appropriately.

Another issue, I think, is that the increase in composting is driven by the solid waste crisis. Thus, the increase in the product that is hitting the market is not being driven by market forces, but by trying to alleviate a solution. Thus, efforts both in the USDA, EPA, Department of Commerce, Department of Transportation, a whole number of agencies, both at the Federal and at the State level can address certain issues.

One is how do we assess the appropriate end uses based on the way the municipal solid waste is today, or what is the quality from a toxic point of view. Having been compost director for Massachusetts, we had also to deal with what we called blue book standards, engineering standards, how do you use compost, what are the most appropriate uses for the end product in different engineering applications, such as landfill cover, highway work, and other public works projects.

Those types of standards also have to be developed. Thus, research and specifications for the end-used products beyond the contaminants needs to be done. Once that is done, then you move into procurement phase.

Criteria four, procurement by the public sector needs to be developed based on these specifications, and along with Mr. Vasuki, I believe that the public sector, through agencies such as the Department of Transportation, the Defense Department, can create a tremendous demand that it will help mitigate the supply that will be coming in the next few years.

Another constraint I find with municipal solid waste composting or cocomposting with sludge is the high cost, and those costs are usually attributed to pretreatment; that is, source separation or size reduction of particles before you compost.

I think it has been said here the composting part of the process is well-proven. What is driving the high cost is separating the material once it comes in as a mass. To emphasize what Ms. Goldstein said, I truly believe that every effort should be made to source separate the material before it comes to a facility. Thus, the quality of the material will be enhanced, and thus, it can be marketed and utilized.

Composting specific fractions of the waste stream, that is, fractions that don't have the problems of contamination or from heavy metals or toxic organics is happening, and if I have to create a priority effort here as far as what the Federal Government should be helping, and I think it is helping with these what I would call source separated wastes that are already source separated out there in the world.

Leaves and yard waste is mentioned. I think there are 30 States right now that are composting leaf and yard waste. There is a number of States that have on their books bans for leaves that are to be implemented between now and 1995.

I am very happy the EPA is getting involved in that area, but that area, I think, is ahead of the EPA, and those areas that haven't come up to speed because of the economics of waste disposal, such as pockets in the Midwest and possibly South, will come up to speed when their costs reflect that.

Another area is commercial organic wastes. In my written testimony, I call it COWS because that is what we call it up in the Northeast. This is material that comes from agricultural processes. In a sense, most of them are food by-products from processing facilities.

This material is relatively clean. We have a good idea of how much is generated per facility. There is not the stigma attached to it that is attached to sludge, or MSW. It comes in usually in consistent quantity and a consistent quality. Also, it has a higher quality in nutrients, which is another pertinent fact when you try to utilize the material.

This type of material, I think, should be addressed, and with a little bit of effort, I think it can be implemented as widely as leaf and yard waste is across the country. There are a lot of good projects out there, that if composted items such as truck farm waste, potato waste, cranberry waste, meat rendering waste, chocolate waste, beer waste, fish processing waste, mushroom waste, apple waste, sprout industry waste, papermill waste, wood waste and the list goes on.

And, also being a recycler, I think in a field, a lot of the recyclers around realize that if we had put the effort in the commercial side of recycling as much as we put it into the residential side of recycling, that we would have diverted a much larger part of the waste stream in a much shorter time. Thus, that is why I think the priorities should be on this commercial side.

The last issue is agricultural waste. One of the things I was asked to do was talk about agricultural waste. When I was compost director for Massachusetts, and along with the State of Maine, we took active programs in, both working with farms and having farms being a solution for waste management issues for surrounding communities.

From an agricultural composting point of view, the issues are that composting can solve an on-point pollution problem. EPA has an agenda for action for that, and I think the USDA and the EPA can work together to promote composting on the farm to help alleviate this very serious problem that, from my point of view, it is about time it is being addressed.

We have also found that composting can make farm operations economically viable. There is a number of ways this happens. One, we have been doing research in Massachusetts to show that manure handling can be actually save money over direct land application of raw manures.

We also feel that because of the application of composts, that there will be subsequent decrease in fertilizer application and need for irrigation. We also feel that the farmer can sell compost, and at the same time get paid for taking in certain types of municipal solid waste. These wastes traditionally have been dried, cleaned in the way of sawdust, paper, corrugated leaves. Farmers made compost and sold it, and have made profits on it.

And at a time in which farms, especially in my neck of the woods, are being threatened by urbanization, anything that can basically make that farm more economically viable is going to be a great help to agriculture as a whole.

Finally, farms are being impacted by urbanization itself. Especially in the Northeast, farms are being surrounded by urbanization, and the largest complaints about farms from these condos, bedroom communities, commercial developments is odors and flies.

We have found that composting is probably one of the most effective ways to deal—to mitigate these complaints. The odor situation, by using composting, has aerobic—that is, with oxygen—degradation, as such. If it is done correctly, you can substantially reduce odors moving off-site.

Once composted, the material can be stored indefinitely, and it also, when it is applied to the land, there is no odor released. Also, the high temperatures in composting not only will make fly larvae unviable, but it also would treat pathogens. That is why EPA has chosen it as a method for sludge treatment.

One final thing is erosion. I just want to point out that compost is one of the few ways to create soil in his country very quickly. Based on my data, we are losing about 1.7 billion tons of top soil a year, and my data is dated. Not only will compost add it to the soil, stem and conserve and add nutrients to that soil, but it will replace that soil.

As far as some additional comments, very, very quickly, as far as the section we are addressing today, I agree that there is not enough time to assess cocomposting. Methodologies for composting, such as wind row composting or static pile composting have been well-tested, and there is plenty of data out there to show that that does work.

As far as in-vessel composting, such as bin, silo, multiply hearth and drum, it would be very hard for the USDA or EPA to do testing on all of those technologies.

I might point out that these technologies have been around in other parts of the world for a long time, and the environmental agencies in those other parts of the world have been looking very seriously at land applying this material, so EPA and USDA may be able to cut their research budget by doing a little cross-boundary fertilization.

Other major issues, I think, has been touched on, I think odor is a major issue. Having put up a number of composting facilities, myself, odor was the thing that would kill it the quickest, and odor treatment can be very expensive, but there is new technology out in using biofilters, using actually soil and compost to clean the gassing, which I think needs further research, and I think it is an appropriate place for USDA to do this research.

Another issue that really needs to be addressed is economic analysis. What I have found is what makes a successful project to get the local public officials to compost is that they have to see the economic benefits. Most of the people don't do it because it is a good idea, and I think that type of economic analysis, both MSW and sludge composting plus what I said before, source separated organic waste composting needs to be continued and expanded upon and then disseminated.

There is an amazing amount of information there that I know both the USDA and EPA has that I haven't seen hit the road yet.

Finally, one area that I think that has the potential for expansion is what we call residential and commercial food waste composting. If you look at this, the food and yard waste is 30 percent. I think we basically have developed the method for yard waste.

The composting part is easy to do. We know how to do it. It is how we collect. But again, I turn to Europe. There are a number of collection systems that have been developed to collect this source separated waste before it gets to a facility, unless you have a relatively clean waste just like you would have with commercial waste.

Implementation of those collection systems requires working with public officials.

Another area that hasn't been really touched on is septage, and I think it is appropriate to the Agriculture Committee because most septage is generated in a rural environment. Septage is what is pumped out of the septic tank. It is what goes into the honey wagon. It is not sludge. The character of it is completely different from sludge. Its sludge content is only 2 to 5 percent, and composting of septage has been tried, but it really hasn't been developed to the extent that sludge composting has been, and I think that is a very important area for research.

And finally, I agree with Mr. Vasuki. I think the liability issue of the land applying materials that are especially high in heavy metals. Those heavy metals will not go away, and over time could come back and haunt both public officials and private entities that are promoting composting.

Thank you very much for the opportunity to talk.

[The prepared statement of Mr. Simpson appears at the conclusion of the hearing.]

Mr. **Brown**. Thank you very much, Mr. Simpson. The full text of your very comprehensive statement will appear in the record.

I don't want to belabor the issue before us too much, and I am not an expert in this area, but what we have with this legislation introduced by Mr. Hochbrueckner is a serious effort to develop a national policy with regard to integrated waste management.

EPA says that they have a national strategy, and they have published it this year, and yet, it is quite clear that the problem seems to be getting more serious and that we are not anywhere close to a solution.

I would like to ask each of you to comment just very briefly, that if we could take one substantive action to begin to reverse this problem of the inability to handle the solid waste problem in this country what should it be? What would be the most effective thing we could do? Spend a lot of money on research, enact tougher standards, develop or adopt a national program that would have some teeth in it, requiring cities to take certain strategies or something of that sort?

Each of you has lived with the problem far more than any of us and probably have some ideas about what could be done, and I would just like to have you give me what you think is the best step we could take.

Mr. **Vasuki**. Mr. Chairman, I come from a small State, probably smaller than some of your Texas counties. We have taken a very strong action program on solid waste and sludge. We do not export our waste anywhere else. We dispose it in our own backyard.

Mr. **Brown**. Could any State do that or any county?

Mr. **Vasuki**. If the small State of Delaware, which depends predominantly on ground water can do it, then almost any other State can do it.

It is a question of political leadership and ability to make decisions in a timely manner.

Mr. **Brown**. At the State level?

Mr. **Vasuki**. At the State level, yes.

Mr. **Brown**. But you had a rather substantial Federal grant to get you started.

Mr. **Vasuki**. Yes, sir, but before the Federal grant was even thought of, the State itself had put up $1 million for research and development in 1970.

The State had a series of environmental laws which looked at the whole environment rather than one slice at a time. We developed a system where we insisted on building first-rate landfills right away, and then developing other programs to supplement the landfills. That is what has given us the strength to do the right things.

Second, there is some misconception about the cost of proper solid waste disposal. Mr. Chairman, I would be glad to submit information to you and your committee, but the cost of solid waste disposal in the State of Delaware averages less than $.07 a day per person.

If you bought one can of soda a week, you will have paid for about 6 or 7 days worth of solid waste disposal. So, it is not an expensive system if it is properly organized.

Mr. **Brown**. You provided us with these two pamphlets?

Mr. **Vasuki**. Yes, sir.

Mr. **Brown**. Did that include the data that you just mentioned, the cost?

Mr. **Vasuki**. No, sir, that doesn't, but I will be glad to submit that.

Mr. **Brown**. We would appreciate your doing that.

[The information follows:]

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November 28, 1989

The Honorable George E. Brown, Jr.
U.S. House of Representatives
Committee on Agriculture
Subcommittee on Department Operations,
Research, and Foreign Agriculture
Room 1301, Longworth House Office Building
Washington, DC 20515

Dear Congressman Brown:

During the hearing on HB 500, November 16, 1989, you inquired about the costs of solid waste disposal and composting. The following is a summary of costs incurred by the residents of Delaware. These costs are true costs (i.e. without any operating subsidies from federal, state or local governments).

TABLE 1

Cost of Solid Waste Collection & Disposal in Delaware

COUNTY	Monthly Collection Cost (1)	Monthly Disposal Cost (2)	Monthly DSWA Management Fee (3)	Monthly Total Cost
New Castle	$12.35	$5.39	$0.26	$18.00
Kent	$12.02	$2.82	$0.16	$15.00
Sussex	$11.62	$3.22	$0.16	$15.00

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(1) Private firm offering collection service once/week.
(2) Disposal fee paid to the Authority by the private firm.
(3) Management fee of DSWA (New Castle County fee includes a $0.05 surcharge collected in behalf of county government).

In New Castle County, the Authority's Northern Waste Management Center (NWMC) serves a population of about 430,000 and includes:

1. The Delaware Reclamation Plant (DRP) - A multi-materials recovery plant with the capacity to process 250,000 tons of household solid waste and up to 91,000 tons of dewatered anaerobically digested (20% solids) sewage sludge. This plant recovers Refuse Derived Fuel (RDF), powdered glass for fiberglass manufacturing, light ferrous metal for steel production, aluminum cans and other scrap for aluminum production, and compost (trademark "Fairgrow") made from a mixture of a select fraction of solid waste and sewage sludge. State and Federal Construction Grants were provided for this facility. As a result, the tipping fee savings are approximately 80 cents per month per family.

2. The Energy Generating Facility (EGF) - A privately owned and operated plant which uses the Refuse Derived Fuel generated by the DRP and select unprocessed solid waste. The plant has the capacity to combust over 175,000 tons per year of RDF and other waste fuel to produce at least 55 million KWH and 400 million pounds of steam for use at a nearby chemical plant.

3. The Cherry Island Landfill - A cellular above-ground, mound-type landfill with dredged river silt as a natural liner and an extensive leachate collection system. The collected leachate is treated at the nearby City of Wilmington Wastewater Treatment Plant. The landfill has gas-venting devices, piezometers, inclinometers and groundwater monitoring wells.

4. The Infectious Waste Treatment Facility - An incineration plant to destroy the infectious wastes generated by the hospitals, laboratories, nursing homes, and other medical institutions or offices will be constructed within the next 24 to 36 months.

In Kent County, Delaware, the Authority's Central Waste Management Center (CWMC) includes a cellular, mound-type landfill utilizing 30 mil. thick PVC liners and the special test cells. All cells have extensive leachate collection systems, gas-venting devices, and gas and water quality monitoring wells. The leachate is recirculated and any excess is treated at a permitted privately owned and operated liquid waste treatment plant. A methane recovery system is under design. A major waste transfer station is also proposed at this center. Approximately 30 acres of open land are being considered for a sod farm utilizing the Fairgrow compost produced at the DRP. About 850,000 tons of solid waste have been safely disposed at this center since it opened in October 1980.

In Sussex County, Delaware, the Authority's Southern Waste Management Center (SWMC) includes a cellular above-ground, mound-type landfill utilizing dual 30 mil. PVC liners. Fly ash from a coal fired utility boiler has been used at this location as a base for the landfill. About one and one half miles of road were also constructed utilizing bottom and fly ash from the power plant. The cells have extensive leachate collection systems, leak detection systems, gas venting devices, and gas and groundwater monitoring wells. The leachate is recirculated through the landfill cells and any excess is treated at a certified privately owned and operated wastewater treatment plant. About 500,000 tons of solid wastes have been landfilled at this center since it opened in September, 1984. A new materials and energy recovery plant will be constructed and operated at this center by January 1, 1994.

The cost of land acquisition for the three landfills is shown in Table 2:

TABLE 2

DSWA Landfill Land Costs

Facility	$ Acquisition Cost	Total Acres	$/Acre
NWMC	2,415,982	342	7,064
CWMC	453,961	529	858
SWMC	714,809	572	1,250

The landfill design and engineering costs are shown in Table 3:

TABLE 3

DSWA Landfill Design and Engineering Costs

			$/Cell Acre	
Facility	Type	Liner	1st Cost	Avg. Cost Next Cell(s)
NWMC	Existing Grade	In-Situ (15 ft.)	28,839	9,530
CWMC	Below Grade	Single (Synthetic)	26,966	9,929
SWMC	Above Grade	Double (Synthetic)	49,320	14,378

The landfill cell construction costs as a percentage of total cell costs are shown in Table 4:

TABLE 4

DSWA Average Landfill Cell Construction Costs As A % Of Total Cell Cost

Cell Construction Item	NWMC (%)	CWMC (%)	SWMC (%)
Liner	0.00	24.29	13.73
Leachate System	22.04	29.13	36.15
Leachate Tanks	0.00	17.95	6.16
Excav./Cut/Fill/Drain	35.24	22.28	40.03
Cell Roads	4.43	6.35	3.93
Cell Dikes	38.29	0.00	0.00
TOTALS	100.00	100.00	100.00
Average $/Cell Acre	53,228	68,100	188,735

The landfill operating costs are shown in Table 5:

TABLE 5

DSWA Landfill Operating Costs As A Percent* Of Total Cost

Operating Cost Category	Facility			Average (%)
	NWMC%	NWMC%	SWMC%	
Contractor's Disposal Cost	41.97	35.70	30.87	36.18
Debt Service	33.37	36.63	48.90	39.63
DSWA Management Fee	6.13	6.97	5.83	6.31
Employee Costs	2.20	4.50	3.93	3.54
Other Contractor's Costs	6.00	0.30	0.10	2.13
Environmental Monitoring	0.77	1.60	0.83	1.07
Reserve for Liability Ins.	6.85	3.80	3.00	4.55
Seep Repair	0.00	2.70	0.73	1.15
Other	2.71	7.80	5.81	5.44
TOTAL	100.00	100.00	100.00	100.00

*3 Year Average

The above tabulated costs were extracted from a paper entitled "True Costs Of Modern Landfills For Three Design Concepts" prepared by the Authority's principal staff.

COMPOSTING SYSTEM:

At the Authority's Northern Waste Management Center, an enclosed bin aerobic compost system known as "Fairfield Digesters" is used to compost sewage sludge and a select fraction of solid waste. The costs of the composting system are given below.

The annual cost of sludge/solid waste (July 1, 1988 - June 30, 1989) composting is as follows:

INPUT	
Sludge	47,265 Tons
Organic rich solid waste	50,000 Tons
OUTPUT	
Digester discharge (raw compost)	65,073 Tons
Finished compost	39,000 Tons

a. Amortized Capital Costs = $1,608,600 (after Federal Grants)

b. Amortized Capital Cost/Ton = $16.54

c. Amortized Capital Cost/Ton of finished compost = $41.25
d. Gross Operating Cost: $7,337,190

e. Revenue from product sale = $864,000 (glass, aluminum and compost)

f. Net Operating Cost = $6,473,190

g. Net Operating Cost/Ton of input = $66.55

h. Net Operating Cost/Ton of finished compost = $165.98

i. Total Annual Cost/Ton of input = $83.09

j. Total Annual Cost/Ton of finished compost = $207.23 or 10.36 cents/lb.

k. Assuming sludge production at 73 lbs./person/year (dry wt.) or 365 pounds (20% solids).

l. Cost per person per day = 10.36 cents

The costs can be further reduced if, as a result of reasonable federal standards, the finished compost can be marketed for agricultural use (non-direct food crops).

U.S.D.A. research and development efforts will help moderate federal and state standards for using compost. Generally, EPA is caught between environmental groups which want to impose extremely stringent requirements currently beyond an achievable level and sludge generators who want more liberal requirements to increase the use of sludge and sludge compost. U.S.D.A., along with FDA, can play a moderating role in developing standards which are achievable, enforceable, and affordable.

I want to emphasize, again, the need for market development and timely adoption of reasonable federal standards. Without either, the Nation will generate and stockpile enormous quantities of sludge and compost. These piles will then start polluting our ground and surface waters. We have the opportunity to avoid such problems if your skillful political leadership can prevent the agencies from going the wrong way.

While composting has a vital role to play in solid waste and sewage sludge disposal programs, we must not forget the need for incinerating a select fraction of solid waste for energy generation and development of modern landfills for waste and for ash disposal which cannot be composted or incinerated or recycled.

The Nation will continue to rely on landfills for all residue disposal and there is no way of avoiding landfills. Recycling, energy recovery, and composting will only reduce the amount requiring landfilling. Therefore, if the U.S. EPA "Agenda for Action" is not successful, our Nation's reliance on landfills will only increase.

The cost of the service for solid waste collection and disposal is very low when compared to other goods and services we all normally utilize daily. The attached chart compares the cost of goods and services for residents of New Castle County, Delaware, where the current Tipping Fee is $42.39/Ton.

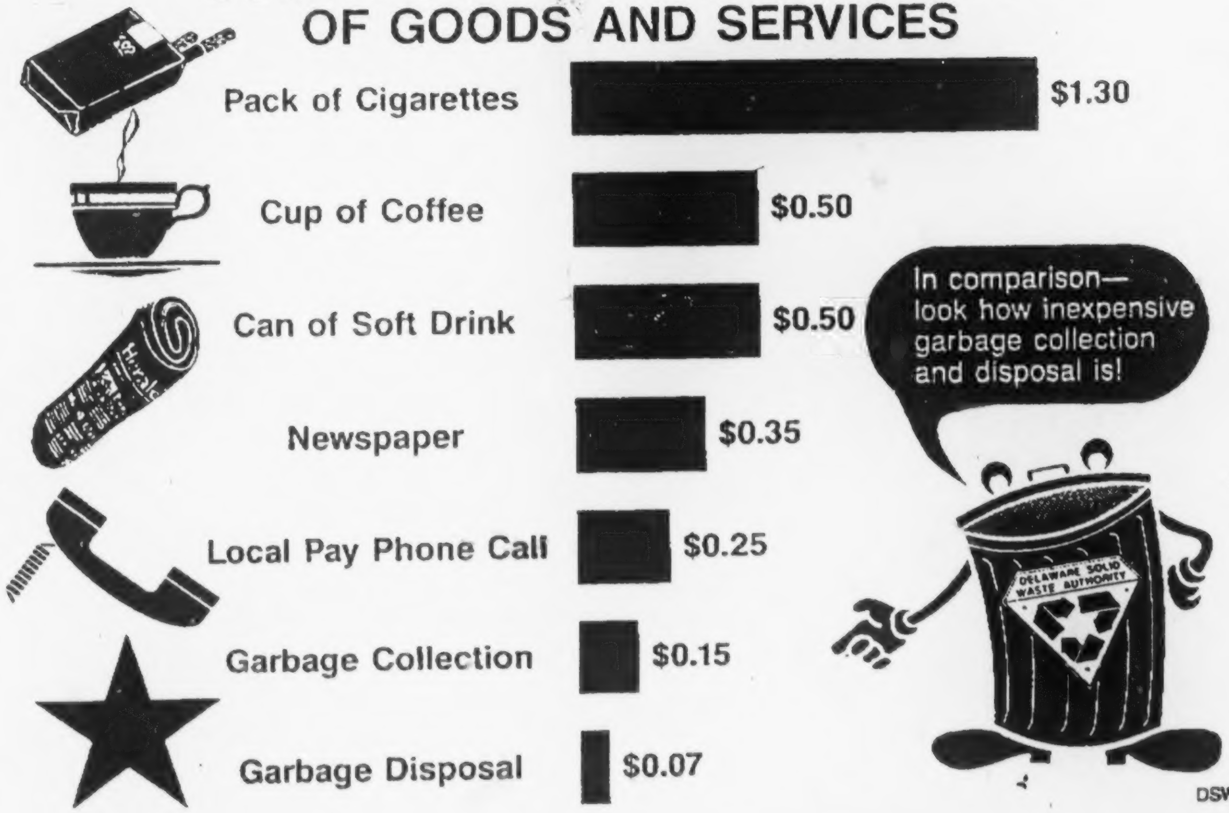
If we can be of further assistance, please call us.

Sincerely yours,

N. C. Vasuki, P.E., DAEE
General Manager

Attachment

COMPARISON OF THE DAILY COST OF GOODS AND SERVICES



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Mr. VASUKI. There are three things involved in solid waste disposal, which if you looked at the State of Delaware as a model, you may find some clues of how things could be done.

First is market. If you develop the market, the supply is not the problem. Let me explain. For example, aluminum is a material which the aluminum companies gladly buy back because they can save some money reusing aluminum. We have no problem in recycling aluminum, and the State has achieved in some places as high as 80 percent aluminum recovery from the waste.

Glass is another material where working with the glass industry we have been able to recycle a considerable amount of glass, and to some extent steel. Paper is a very difficult problem. What the Nation needs is not exporting paper to Taiwan or South Korea. What we need is new papermills in this country, and unless we build those new papermills, we are not going to recycle paper.

The second thing is there is a certain portion of the organic waste, and I beg to differ from Mr. Hochbrueckner, about 40 percent of the organic waste cannot be composted, and the best thing to do is to put that towards useful energy, whether we produce 1 kilowatt hour of electric power using coal or oil or paper fraction of the solid waste, it makes no difference to the environment. They all contribute to the same amount of carbon dioxide and other material.

So, to the extent practicable, particularly in the urban areas, we ought to make use of at least 40 percent of the urban waste for energy production.

Composting is a very important portion, but as I said, composting is easy to do, but to sell the compost is very difficult, and if anything the committee can do to enhance the use of compost in Federal projects, it would certainly help in the market.

Mr. BROWN. Well, both you and Mr. Simpson made that recommendation, that we provide a market on Federal, and I presume State highway and public works project as well as things like forest use and mine reclamation.

If we were to adopt that as a national policy and make it a requirement, would that provide a substantial incentive, the market that you say is needed?

Mr. VASUKI. Yes, sir.

Mr. SIMPSON. I will agree with that. In fact, Minnesota is already doing that and has made a tremendous amount of difference in that State.

Mr. BROWN. Either of the other two wish to add to what Mr. Vasuki said?

Ms. GOLDSTEIN. Because we are with the Agriculture Committee instead of some of the other committees on the Hill that deal with solid waste, we were very excited to see this portion, section V, of the bill to draw the connection, once again, with agriculture and base management.

While we are excited about the developments in sludge composting, hardly any sludge compost, at this point, at least in our surveys, goes to agricultural utilization. When you hear about projects and you asked them what their markets are, they cite horticultural landscaping applications, the bulk of the Delaware reclamation. And that is pretty much where the focus has been.

I think the key, if there is a Federal role, I guess I would say it is important to see this section, or the agricultural utilization would be a very strong market for compost, and there is a need for it from the erosion stand-point for decreasing use of chemical fertilizers and pesticides to build up the organic material, and the soil compost has those different elements and the capabilities to do that.

There is the limitations and the drawbacks, let's say, from potential contaminants that would hurt market development, but there are mechanisms in place through the Clean Water Act's pretreatment program through maybe something the Federal legislation could somehow try to set standards for household hazardous waste.

Those would all be very beneficial steps that would help to create a quality end product that could be using agricultural applications.

I guess I would just repeat what I said earlier about the agricultural utilization aspects of section V is really important, and I think it is necessary for USDA to get back into the organic waste research business. They did an excellent when they were doing it.

States have taken, in the absence of Federal action—many States are far out ahead of the Federal Government in terms of their policies to encourage composting, to encourage recycling.

So, I don't want to see anything that might hinder those developments, and so people have been surviving in absence of Federal research dollars and the like, but certainly there is a need, and if there was ever a need to pursue it, this is a very good time, and so I guess I would say that just the fact that the agricultural connection has not really been made strongly enough, I don't think.

Mr. **Brown**. I wouldn't want any States to get the idea because of this hearing that we are going to have a large infusion of Federal money into this in the near future.

But, there is a role for the Federal Government to take. It is an appropriate role, with or without the ability to put a lot of money into grants to the States, and this committee wants to know what that role is and how we can perform it as effectively as possible.

Mr. **Simpson**. The agenda for action that Mr. Weddle talked about that he is going to give you a copy of, that really was a result of a process that occurred about 2 years ago down at the homestead in Virginia where 200 professionals in the solid waste field, nonprofit, the public sector and the private sector came together to talk about this, what the EPA can do.

And what I think you see in that agenda is what the States were telling them. They were saying, "We're doing this. We're doing it well. We're not going to jump through some Federal hoops to do something because we don't have the time to do it."

So, what I think you see is a culmination of that whole process in this agenda, so I would recommend that you take a look at it because it had a lot of local input into it.

To give my 2 cents on what I think the Federal Government can do is first of all, they can do what they should be doing. As Nora said, there are a number of programs that are already on the books, such as source reduction, industrial pretreatment, a move for taking household hazardous waste out. All those things should be done. They are not being done effectively.

One of the reasons, when I was in Massachusetts, I have a lot of composting operations in Massachusetts, but the reason I couldn't move my compost was primarily because the pretreatment programs that were supposed to be in place were not being enforced, and we were getting what I would call Type III compost, which means the only place we could put it was landfills, and it had to go into the registry of deeds to do that.

So, that is a great disincentive for composting. To give you a little secret, and my learned colleagues probably know about my history, the reason I have been successful in sort of doing composting is I choose where I do composting. I go to situations where the economics work; that is, there is a crisis on hand, disposal capacity is in a short fall, and traditional methods are being upgraded to meet efficient environmental, state-of-the-art standards.

Thus, I walk in with a recycling or composting strategy. I come out with a workable project.

I think that if the Federal Government, for example, came up with the correct rules and regulations for closure of landfills, opening of new landfills really met state of the art and really showed what the real costs for that process is, I think all of a sudden you would see whole sections of the country that have not been part of this process become part of this process because the true costs of the disposal are being realized.

So, I think the Federal Government—it is incumbent upon them to start to stop saying that they are going to do this, and I am not saying that the Federal Government, as a whole, but possibly EPA specifically. If they want to do it, then go ahead and do it because it will solve some of those other problems that we have been talking about today.

Mr. BROWN. Well, we very much appreciate the contribution you have all made to the subject matter here this afternoon, and we will not keep you any longer. If we do have some additional questions to complete the record, we will have the staff communicate them to you, and we hope you will be able to respond.

Thank you very much for being here. The subcommittee will be adjourned.

[Whereupon, at 4:20 p.m., the hearing was adjourned, subject to the call of the chair.]

[Material submitted for inclusion in the record follows:]

Statement of
CONGRESSMAN GEORGE J. HOCHBRUECKNER

Before the
Subcommittee on Department Operations,
Research, and Foreign Agriculture
November 16, 1989

Mr. Chairman and members of the Subcommittee on Department Operations, Research and Foreign Agriculture, thank you for allowing me this opportunity to testify on the Recyclable Materials Science and Technology Development Act (H.R. 500). As you know, this is a bill I have introduced to establish a comprehensive program to promote recycling and composting of garbage nationwide.

I commend the members of this subcommittee for your leadership in considering this legislation. Chairman Brown, an original co-sponsor of H.R. 500, has been very helpful to me in arranging for this hearing. I know that your committee's schedule is full, and I thank you for considering this bill so close to the end of session.

Our nation faces a looming garbage crisis which the Congress cannot ignore. Americans generate 160 million tons of trash each year. Only about 10% of this garbage is being recycled, while over 80% is entombed in landfills. Yet, more than 3,000 landfills have been closed in the past five years and by 1993, one-third of all remaining landfills will be closed. In my distict, all landfills must close permanently one year from now under a New York State law. More and more jurisdictions in this nation are running out of places to hide their waste, and they have seen no leadership from Washington in addressing the problem.

As our colleagues from the nation's heartland are increasingly aware, a response to this crisis by municipalities in the Northeast has been to export solid waste to other regions for disposal. Last year, 1.1 million tons of trash from my state were sent to out-of-state landfills -- a 44% increase over the amount of trash New York exported in 1986. Garbage has earned the dubious distinction of being Long Island's chief export commodity by weight -- far surpassing exports of potatoes, duckling and seafood.

Local officials on Long Island and across the country are instituting a variety of programs intended to reduce the amount of trash generated and increase the proportion of the waste stream routinely separated for recycling. Nonetheless, the instability of markets for recyclable materials and the absense of reliable technologies for sorting, transporting, and reprocessing post-consumer materials is causing serious setbacks for local recycling efforts.

In response to this growing national concern, a bipartisan group of 141 members has joined with me in sponsoring H.R. 500. This legislation authorizes research into potential markets for recyclable materials and technical assistance to municipalities and industries in designing appropriate recycling technologies for various materials in the waste stream.

In addition to the Agriculture Committee, H.R. 500 was jointly referred to the Energy and Commerce, Armed Services, and Science, Space, and Technology Committees. The Natural Resources Subcommittee of Science, Space, and Technology held a hearing on August 10, 1988, on virtually identical legislation, H.R. 5000, which I introduced on July 7, 1988. Subcommittee Chairman Jim Scheuer has informed me that the subcommittee intends to take up H.R. 500 during this Congress.

The Armed Services Committee approved a modified version of H.R. 500 section 4 as an amendment to the Defense Department Authorization Act (H.R. 2461), which has been approved by a House-Senate conference committee. That final measure calls for a Pentagon report on the feasibility of recycling trash from military bases. Additionally, a hearing was held on July 12, 1989, on H.R. 500 in the Energy and Commerce Subcommittee on Transportation and Hazardous Materials.

After today's hearing, H.R. 500 will have been reviewed in all four House committees with jurisdiction. I am hopeful that we can move this legislation to the House floor during this Congress.

I believe that the principal area of jurisdiction for the Agriculture Committee is section 5 of H.R. 500, which authorizes a Department of Agriculture (USDA) research project to examine technologies for composting solid waste and for "co-composting" trash with sewage sludge.

Composting reduces biodegradable wastes to a mulch-type material through accelerated natural decomposition. It is an ancient technology that could hold significant promise for modern society, both on a large municipal scale as well as on a back-yard residential basis. Finished compost can be used in landscaping, horticulture, and as a soil conditioner.

It is estimated that composting techniques could be used to manage one-third of the nation's municipal solid waste. Materials suitable for composting include fallen leaves, grass clippings, and certain post-consumer wastes composed of organic materials. In addition, trash can be co-composted together with sewage sludge -- a potentially attractive alternative for municipalities in search of safe land-based sewage sludge disposal methods. As we will hear from one of our witnesses this afternoon, the City of Wilmington, Delaware, composts all of its sewage sludge, which means that the city has no need to construct expensive sewage treatment plants or to dump its sewage sludge in the ocean.

The USDA studied waste composting during the 1970s, and helped to provide guidance for the more than 100 sewage sludge composting facilities currently operating in the United States. As I understand it, a number of these facilities have experienced problems, such as unsuccessful temperature and odor controls. Several sludge composting plants have been shut down due to such problems. In my judgement, it is appropriate for USDA to revisit this technology and identify the best systems for composting various elements of the waste stream.

The members of this committee may wish to explore the potential benefits of expanded composting in the farm sector as well. Runoff of manure and other agricultural wastes into groundwater, rivers, lakes and estuaries has been of major concern to the environmental community. Perhaps there is a larger role for composting to play in transforming potentially hazardous farm wastes into harmless mulch. USDA might also be directed to analyze the suitability of compost as a soil conditioner and stabilizer in association with food and non-food crops. Members of the horticulture industry are interested in utilizing compost derived from solid waste, but growers need to have assurance that such compost does not contain hazardous substances.

Let me conclude with the suggestion that composting could prove to be the "sleeping giant" of waste management. If compost operations can be designed to be cost-effective, convenient to the generators of compostable wastes, and non-offensive to nearby communities, then the technology should prove to be a highly attractive alternative to landfilling and incineration. Furthermore, if finished compost can be demonstrated to have value as a soil additive, then we will be advancing a truly natural system of recycling.

Mr. Chairman, I hope that you and the members of this subcommittee will consider pursuing H.R. 500 so that we can move ahead with a progressive approach to waste management. Thank you for your time, and I would be happy to answer any questions you may have.

STATEMENT OF
BRUCE WEDDLE
ACTING DIRECTOR, MUNICIPAL SOLID WASTE PROGRAM
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON DEPARTMENT OPERATIONS, RESEARCH, AND FOREIGN AGRICULTURE OF THE COMMITTEE ON AGRICULTURE
U.S. HOUSE OF REPRESENTATIVES

NOVEMBER 16, 1989

Introduction

Good afternoon, Mr. Chairman and Members of the Subcommittee. My name is Bruce Weddle, and I am the Acting Director of the Municipal Solid Waste Program at the Environmental Protection Agency (EPA). With me today from EPA's Office of Water Regulations and Standards, which has lead responsibility for reuse and disposal of sewage sludge, is Bill Diamond, Director of the Criteria and Standards Division. We are pleased to have the opportunity to appear before you this afternoon to discuss the ever increasing problem of the safe management of municipal solid waste and of sewage sludge, and the appropriate role of composting in addressing these problems.

As you are aware, both municipal solid waste and sewage sludge are important components of the nation's solid waste. However, these components are usually managed at different facilities and are regulated under different environmental statutes. Consequently, this morning when we discuss the issues surrounding their improved management, we will be discussing them separately until we turn to the question of co-composting and comments on Section 5 of H.R. 500.

Scope of the Problem

Municipal Solid Waste. This country is generating more and more garbage every year. In 1960 the United States generated about 87 million tons of municipal solid waste. Today, we produce nearly 160 million tons annually, and EPA has projected that rate to increase to over 190 million tons by the year 2000.

At the same time, the capacity to safely and efficiently handle this waste is dwindling. Currently, 80% of the nation's garbage is disposed of in landfills. We estimate that more than 40% of these will close in the next five to seven years. Therefore, we must act quickly to eliminate the gap between the amount of solid waste generated and available capacity in secondary markets for recycled materials, incinerators, and landfills.

In addition to landfilling, we recycle approximately 10% of our garbage, and incinerate another 10%. The percentages being incinerated and recycled are increasing.

Given this scenario, EPA issued a national strategy called "The Solid Waste Dilemma: An Agenda for Action" in February, 1989. This report presents a strategy for improving the nation's management of municipal solid waste with recommendations for actions to be taken by EPA, state and local governments, industry, and private citizens to address our growing waste management problems.

The "Agenda" proposes integrated waste management as the key to resolving the dilemma. Integrated waste management refers to the complementary use of a variety of waste management practices. An integrated waste management system will contain some or all of the following elements:

- o Source reduction (including reuse of products);
- o Recycling of materials (including composting);
- o Waste combustion (with energy recovery); and
- o Landfilling.

Each element of the system works with the others to form a system for proper management given the nature of the waste generated and the environmental, economic, and institutional needs of the locality for which the system is planned and implemented.

The "Agenda" also established several national goals. The most germane to today's discussion was to achieve a 25% reduction in municipal waste requiring incineration or disposal by 1992 using a combination of source reduction and recycling measures.

Municipal Sewage Sludge. In addition to the municipal solid waste we have just discussed, approximately 15,300 publicly owned treatment works (POTWs) generate 7.7 million dry metric tons of sludge annually, or 64 pounds on a dry weight basis for each individual in the United States. This volume is expected to double by the year 2000 based on population growth, stricter wastewater treatment requirements, and a greater number of better-operated POTWs.

End of pipe treatment approaches alone are not the answer to managing wastewaters from our nation's sewer system. Communities must consider implementation of waste separation and water conservation programs, and separation of stormwater from wastewater sewer systems. These measures have proved successfulin reducing the volume of wastewater generated and in improving the quality of the sewage sludge which is ultimately used or disposed.

Once wastewaters reach POTWs, however, treatment of the wastewater yields sludges which can, in many cases, be reused beneficially. EPA has a policy that actively promotes the beneficial use of sewage sludge (published at 49 FR 24358 on June 12, 1984). Further discussion of this policy and of EPA's proposed technical sludge regulations is contained in a booklet entitled "EPA's Policy Promoting the Beneficial Use of Sewage Sludge and The New Proposed Technical Sludge Regulations, June, 1989." Furthermore, EPA has a national awards program that recognizes outstanding operating projects, technological development activities and research that have promoted the beneficial use of sludge.

Composting As Part of the Solution

Municipal Waste. If we are to achieve 25% source reduction and recycling by 1992 -- a goal established in the "Agenda for Action", we will need to concentrate our short term efforts on finding components of the municipal waste stream which are amenable to these techniques and which represent a significant portion of the waste stream. Curbside and other collection and marketing programs which focus on easily recyclable materials such as paper, metals, and glass can net as much as a 10-15% reduction in municipal wastes destined for disposal. A few communities have been able to achieve higher rates. However, in order to reach our 25% goal, we believe that many communities will need to institute yard waste collection and composting programs.

Yard wastes (e.g., debris such as grass clippings, leaves, brush, and tree prunings) have been estimated to comprise approximately 18% of the national annual municipal waste stream gross discards. The precise generation rate for yard waste, as well as its composition, varies by season, year, and region. In fact, during the peak months of their generation (i.e., primarily during the summer and fall months) yard wastes can represent 25-30% of municipal waste. Landfilling and incineration are poorly suited to the management of leaves and grass. Since yard wastes are relatively clean, biodegradable material, landfilling is unnecessary and inefficient, wasting precious landfill space. Also, decomposition of yard wastes can ontribute to formation of methane gas and acidic leachate, as well as contribute to uneven settling at landfills. The seasonal nature of yard waste generation can cause incinerators designed to handle this type of solid waste to be over-sized. Furthermore, the high moisture content of this type of waste inhibits complete combustion.

Yard wastes can be source separated and composted into a soil amendment or mulch for use by residents, nurseries, park services, government and private landscapers, and other groups. Mixed into the soil as an amendment, compost can improve the soil's physical, chemical, and biological properties. As a mulch, compost can modify soil temperatures, reduce erosion, control weeds, and improve moisture retention.

Yard waste composting has great potential as a municipal solid waste management option in the U.S.. There are estimates of as many as 800 - 1,000 yard waste composting facilities currently operating in the nation, and we expect that many more will begin operation as landfill space continues to grow scarcer and as communities implement programs to reach the 25% recycling goal. Further, the rapid escalation of landfilling costs will stimulate community actions to find alteratives such as yard waste composting. Several states have already passed legislation prohibiting some or all of the yard waste stream from disposal -- some examples include New Jersey, Minnesota, and Florida. Other states, and counties as well, have passed or are proposing similar bans.

The component of municipal waste which is most similar in terms of composting potential is food waste -- which represents about 8% of all municipal wastes compared to the approximately 18% represented by yard wastes. Given this smaller volume and the difficulty in collecting food wastes and other household compostables separately (e.g., envelopes, tissues and other compostable items which are not currently being recycled), we concluded that we need to focus our efforts on helping local governments to implement yard waste composting programs.

Sludge. Treatment works frequently digest or compost their sewage sludge to reduce the level of pathogens and odors and greatly facilitate product useability. The degree to which a sludge is processed is very important when applying sewage sludge to land, when distributing and marketing it, and when placing sewage sludge in monofills or on surface disposal sites in order to eliminate the spread of pathogenic diseases.

Sewage sludge which has been appropriately processed may be beneficially reused through application to both agricultural and non-agricultural (e.g., forest) lands to improve the condition and nutrient content of the land as well as to hasten stabilization and revegetation. Nine percent of the sewage sludge generated is distributed and marketed for use as a substitute for topsoil and peat on lawns, golf courses, parks, and in ornamental and vegetable gardens. Usually sludge which is marketed in this manner is composted. Sludge composting consists of dewatering the sludge; mixing it with a bulking agent such as wood chips, bark, rice hulls, straw, or previously composted sludge; and allowing decomposition for a period of time. In this form sludge is dry, and is thus easier to distribute and handle. Value of the sludge compost has been estimated at $100 to $125 per dry ton as a component of potting media.

On February 6 of this year, EPA proposed standards for the disposal of sewage sludge. The proposed standards include requirements for all the various types of sludge management options, including two which are of particular interest to the Committee today, land application and distribution and marketing. In addition to accepting written comments from the public, EPA held three two-day workshops to discuss the technical basis for the proposal and conducted four public hearings on the standards. We are now in the process of reviewing the comments we received, and expect to promulgate the rule in October of 1991. The proposed standards would establish limits for pathogenic organisms or indicator organisms for sewage sludge applied to the land or distributed and marketed. The proposal would also require the distributor to include information sheets or labels which identify the contents of the product and provide instructions on proper use of the product.

Co-Composting. Attempts to co-compost sewage sludge with mixed municipal wastes which have not been source separated (and which contain a significant percentage of non-degradable materials) have not achieved notable success to date. I would point out, however, that much of the experimentation in this area was conducted in the early to mid-1970s, before many of technological innovations which have since been successfully applied to composting sewage sludge were available. We would therefore expect that improvements in the results of co-composting experiments over past efforts could be achieved. Nonetheless, it is clear that to the extent that non-degradable items are contained in composted materials, as they are virtually certain to be in any co-composting program which includes whole stream municipal solid waste, their removal would add unnecessary steps to processing and marketing the final product, and is inconsistent with existing state-of-the-art practices. The more modern and advanced facilities now rely on source separation at the household, followed by additional source separation at the facility before composting.

EPA's Current and Planned Activities

The Agency has a number of activities underway or planned which are designed to encourage composting of yard waste and to ensure that composting is done in an efficient and environmentally sound manner. In April of this year we published a booklet entitled "Yard Waste Composting: A Study of Eight Programs". This booklet examines the various approaches to and aspects of successful community yard waste composting efforts and programs, and includes information concerning programs in Seattle, Washington, and Omaha, Nebraska, as well as n six other locations across the country. We are currently developing an evaluation of markets for products from composting yard waste and, with our Office of Research and Development, a guide to composting yard waste and municipal solid waste.

We are also in the process, now virtually complete, of updating an earlier EPA publication entitled the "Decision Maker's

Guide to Solid Waste Management." This guide discusses the importance of composting as one of the key options to be considered as local decision makers design and implement a municipal solid waste strategy.

These materials will be supplemented by guidelines for composting, on which work will soon begin. All of these materials will be made readily available to local communities. As you can see, EPA has been actively involved in developing and disseminating the needed information to ensure that as a nation we do not fail to consider and implement yard waste composting programs as we work toward resolving the municipal waste dilemma now facing us.

In the area of sewage sludge composting, EPA continues to play a major role. The USDA and universities have been partners with EPA in efforts to develop the technology and to establish the scientific understanding that has allowed development of regulations and guidance for safe use of composted sludge products.

Since 1973, when these efforts began, more than 200 POTWs have started work on this technology. A number of these POTWs compost major portions of their sludge -- for example, Washington, D.C., Philadelphia, Denver, Los Angeles, and the San Francisco Bay area.

The technology has been developing rapidly. The focus today is on more mechanized systems produce marketable compost in a cost effective fashion while controlling odor. EPA's most recent publication in this area concerns an evaluation of in-vessel composting systems now being operated in the United States. The publication is entitled "Summary Report: In-vessel Composting of Municipal Wastewater Sludge, September, 1989." A second publication is now being developed to help municipalities valuate, design and operate sludge composting facilities with a primary emphasis on odor control. Much of this information would also be applicable to co-composting situations.

Comments on Section 5 of H.R. 500

H.R. 500, introduced to encourage scientific research and development of technologies relating to recycling, would require the U.S. Department of Agriculture to conduct a pilot study and subsequently report to Congress on, co-composting of municipal solid wastes and sewage sludge. My previous remarks have addressed the need for increased recycling of all types of materials which are reasonably amenable to recycling and the urgency of acting quickly to head off a crisis in which some communities literally have nowhere to put their municipal wastes. I would like to take this opportunity to provide both some general remarks regarding the goals of this bill and to provide some specific comments as well.

In our current situation, exploration of how, and under what circumstances, the advances we have made since early co-composting attempts could be applied to "mixed source" composting is of interest to all of us involved in exploring, evaluating, and expanding the various waste management options available. Nonetheless, for the present in the municipal solid waste area, EPA would place a higher priority on evaluation of markets, both existing and potential, for products of single source composting efforts which we know are being successfully achieved at present -- notably, sewage sludge and yard wastes. Such market evaluations include characterization of technologies and compost products and establishment of limitations needed for their safe and beneficial use. Other priority efforts would include developing guidelines to ensure that composting is done in an environmentally sound manner and that compost products meet basic quality and health standards, and finding methods to encourage markets for composting products.

With regard to the specifics of Section 5 of the bill as it currently reads, EPA's views are as follows:

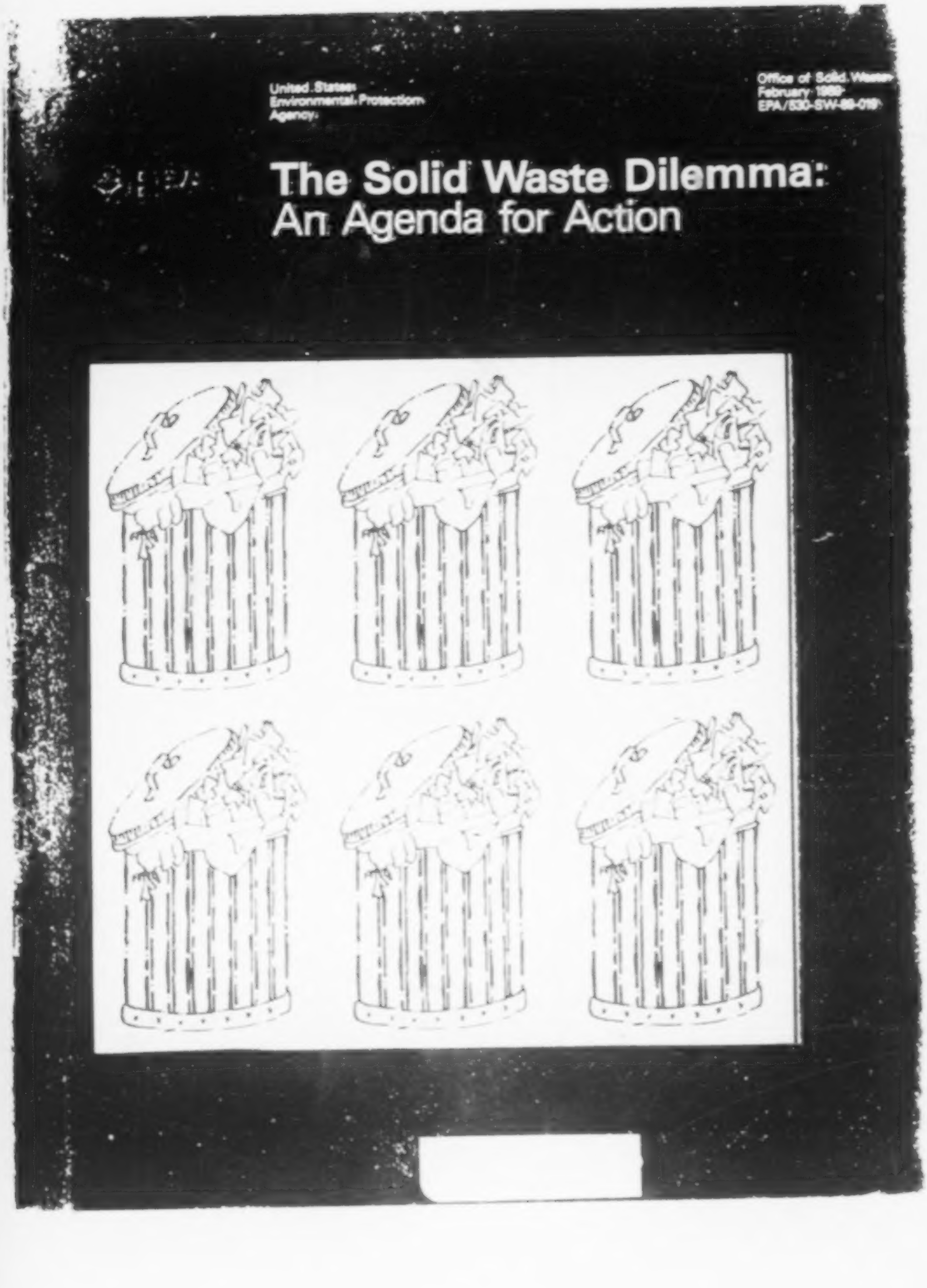
o Development and evaluation of technologies for improving our ability to co-compost municipal and other solid wastes with sewage sludge and produce marketable products could expand opportunities to increase our recycling rate in the future, and USDA has both the expertise and the experience to fill this role. However, in view of the relatively small volume, and the collection problems described above, we believe Federal attention is better focused initially on yard waste composting programs and sewage sludge composting efforts.

o EPA cannot support the provision of Section 5 (b)(2) which implies that effective separation of non-degradables can or should occur after composting has taken place rather than before. In order to promote reuse and expand product markets we must ensure that products are of high quality. Concerns over product quality are not limited to the presence of contaminants like plastic or small bits of glass which are aesthetic problems and lower the value of the compost. We are also concerned that household hazardous wastes (e.g., pool chemicals, pesticides, solvents, tc.), which make up approximately 1% of the total municipal solid waste stream could create additional problems. Therefore, our revious experience in this area, and all the other information we have indicates that to produce high quality compost, materials separation must occur before composting, and, where possible, separation at the household level can yield additional benefits.

o Consistent with EPA's view of composting on municipal wastes which have not been separated into degradables, we do not believe that a pilot project of this nature would yield "recovered non-degradables" appropriate for use in construction materials and for other materials as suggested in Section 5 (b)(4).

o While EPA defers to USDA's views on this matter, we believe that providing only one year to plan, implement, evaluate, and report to Congress on a pilot project on composting is too ambitious,and deserves reconsideration by the Subcommittee.

This concludes my prepared remarks. I appreciate the opportunity to appear before you today, and my colleague, Bill Diamond, and I will be happy to respond to any questions you may have at this time.



United States
Environmental Protection
Agency

Office of Solid Waste
February 1989
EPA/530-SW-89-019

The Solid Waste Dilemma:
An Agenda for Action

Americans produce more and more solid waste each year; we generate more per capita than any other nation. But, at the same time that we generate more waste, we are running out of places to dispose of it. Landfill capacity in some places is almost filled to the saturation point, and solid waste facilities continue to be difficult to site because of public resistance, commonly known as the "Not In My Backyard" (NIMBY) syndrome. Public resistance is often based on environmental concerns, unpleasant smells, noise, and truck traffic. Public resistance is not limited to landfills and combustors. Even materials recovery facilities and recycling centers can be difficult to site. (The feckless voyage of the "garbage barge" in 1987 and the ash barges last year have become national symbols of America s solid waste dilemma).

Although solid waste management is primarily a local responsibility, the problem is national in scope, and we need a national strategy to solve it. In response to this burgeoning problem, EPA created a Municipal Solid Waste Task Force in February 1988 and directed it to fashion a strategy for improving the nation's management of municipal solid waste. The following report was developed after extensive public input and consultation with a variety of knowledgeable groups and individuals.

The Agenda for Action offers a number of concrete suggestions for action by not only EPA, but also government at all levels, industry, and private citizens. This Agenda cannot be accomplished by government acting alone. Its accomplishment is contingent on a strong partnership among government, industry and the public. It calls for a "systems" approach to managing municipal solid waste; that is, the complementary use of source reduction, recycling, combustion and landfills to comprehensively manage municipal solid waste. It also underscores the need for a fundamental change in the nation's approach to producing, packaging and disposing of consumer goods. In the past, "business as usual" meant an accelerating trend toward disposable products, convenience packaging, and an "out-of-sight, out-of-mind" attitude toward solid waste. As a nation, we can no longer afford this kind of "business as usual." We must adopt a new solid waste management ethic that minimizes the amount and toxicity of waste created by the products we make and purchase, produced during the manufacturing process, and generated by our day-to-day activities as consumers. That ethic must also maximize the amount of waste materials that are reused and recycled so that we achieve a fully integrated system for waste management. In short, we need to change the way we do business. This change will not be easy, but if we work diligently together, we will achieve our goal. I hope this report will serve as a centerpiece for this change.

The Agency is very encouraged by the strong support for the Agenda for Action that was expressed by states, localities, public interest groups, the waste management industry and the manufacturing industries. This support shows a real commitment to implementing the Agenda for Action. Based upon public comments, the Agenda has been modified somewhat. The most noteworthy changes are:

- To meet our 25 percent source reduction/recycling goal by 1992, greater emphasis is placed on composting. Development of quality guidelines and standards or guidelines for operation of compost facilities are also planned.
- No specific source reduction/recycling goal is established beyond 1992; however, the Agency anticipates that the 25 percent level will be exceeded, as capital equipment comes on-line for recycling various commodities, including paper.
- The goal for source reduction is articulated more clearly to indicate that we should reverse the ever-increasing per capita generation of garbage.
- More emphasis is placed on a "systems" approach to waste management, since meeting a 25 percent recycling and reduction goal still leaves 75 percent of the waste stream to be managed.
- Household hazardous waste (HHW) issues are noted in more detail and are included in the source reduction activities section.

- The need for better communication by states and localities to enhance siting is discussed, and EPA's communications experts are committed to working on this issue.

Finally, several changes to the schedules have been made, to reflect public comments and other factors.

--J. Winston Porter
Assistant Administrator
Solid Waste and
Emergency Response

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EXECUTIVE SUMMARY

This report is about what the government calls municipal solid waste, and almost everyone else calls garbage. As a nation, we generated about 160 million tons of solid waste last year; by the year 2000, we are projected to generate 190 million tons. This report is about how we should handle this outflow of refuse - the cans, the bottles, the leaves and lawn clippings, the paper and plastic packages, the broken furniture and appliances, the uneaten food and the old tires. This deluge of garbage is growing steadily and we must find ways to manage it safely and effectively. Eighty percent of garbage is landfilled. But we're running out of space to bury it in existing landfills; more than one third of the nation's landfills will be full within the next few years and many cities are unable to find enough acceptable sites for new landfills or new combustors. To eliminate this growing capacity gap, all levels of government, the public and industry must forge a new alliance to develop and implement integrated systems for solid waste management.

This report presents the goals and recommendations for action by EPA, state and local government, industry and private citizens to address the municipal solid waste management problems that are facing this country. These goals and recommendations are the result of the efforts of EPA's recently created Municipal Solid Waste Task Force. The Task Force gathered existing data on municipal waste and problems regarding its management, solicited input from interested persons and groups, held public meetings and developed a number of options to address these problems. This summary data is contained in a supplemental document titled ''Background Document for the Solid Waste Dilemma: An Agenda for Action.''

The types and extent of the problem in managing municipal solid waste vary from region to region depending on waste type, land use and demographic characteristics, but some trends and problems are clearly national in scope. From 1960 to 1988, we generated more waste every year, both in total tonnage and in pounds per person, and this trend is projected to continue. In addition, we are running out of places to put our waste because old landfills are closing and few new landfills and combustors are able to be sited and built. There are concerns about potential threats to human health and the environment from combustor emissions and ash, from landfill emissions, leachate, and litter. High costs are borne by the waste generator and handler, as many areas of the country resort to shipping waste long distances by truck and rail to areas with available landfill or combustor capacity. Recycling, although a waste management technique popular with the public, is used currently to manage only 10 percent of our nation's waste, and is successful only when participation in separation and collection is high and market prices for secondary materials are favorable. Siting of recycling facilities is also becoming more difficult. Finally, manufacturers of products have no direct incentive to design products for effective waste management because they are not usually directly responsible for the ultimate costs of waste management. Similarly, most consumers do not have a direct economic incentive to throw away less, because they are not usually charged based on the amount they throw away.

This report recommends using "integrated waste management" systems to solve municipal solid waste generation and management problems at the local, regional, and national levels. In this holistic approach, systems are designed so that some or all of the four waste management options (source reduction, recycling, combustion and landfills) are used as a complement to one another to safely and efficiently manage municipal solid waste. The system is "custom designed" to meet local environmental, economic and institutional needs. A key element of integrated waste management is the hierarchy, which favors source reduction (including reuse) to first decrease the volume and toxicity and increase the useful life of products in order to reduce the volume and toxicity of waste. Recycling (including composting) is the preferred waste management option to further reduce potential risks to human health and the environment, divert waste from landfills and combustors, conserve energy, and slow the depletion of nonrenewable natural resources. In implementing source reduction and recycling, we must avoid shifting risks from one medium to another (e.g., groundwater to air) or from one population to another. Landfills and combustors will be necessary for the foreseeable future to handle a significant portion of wastes, but are lower on the hierarchy because of the potential risks to human health and the environment and long-term management costs. This risk potential can be largely minimized through proper design and management. Integrated waste management can and should be implemented at a local level to the extent practical, and is a useful conceptual tool for making management decisions. But, it is not meant to be rigidly applied when local unique waste and demographic characteristics make source reduction and recycling infeasible.

The integrated waste management system is the framework for the national goals presented in this report. This report presents EPA's stated goal of managing 25 percent of our nation's municipal solid waste through source reduction and recycling by 1992. Composting of yard waste will play a key role in attaining this goal. While no long-term numerical goals are established beyond 1992, the Agency anticipates that the 25 percent level will be exceeded as capital recycling equipment comes on line. This will be especially true in the paper industry, where planning today will be essential to increasing domestic paper recycling in the mid-1990's. In addition, we must strive to reverse our ever-increasing per capita generation of garbage. We also must work to reduce the risks associated with landfills and combustors, inasmuch as these management alternatives will be necessary to handle most of the wastes. The risks of recycling need to be examined to determine if risk reduction is also needed for recycling. By implementing these goals, we can solve or reduce many of our municipal waste management problems.

This report outlines EPA's program to address these goals. It also presents a number of recommendations for state and local governments, industry, and consumers that will enable us to meet these goals. Information, assistance, and data must be made more accessible to everyone by generating catalogs of available materials, establishing a national clearinghouse, developing a "peer matching" program to allow all levels of government and waste management to exchange expertise, and developing a national research agenda for collecting new information and developing new technologies.

Planning at all levels of government is recommended in the report. National and regional planning conferences are needed to facilitate the exchange of information. This report contains a list of elements that state and local municipal solid waste management plans should include.

Source reduction should be fostered at the manufacturing, governmental, and local levels. EPA will study options for reducing lead and cadmium in products in order to reduce the risks of combustor emissions and ash, landfill leachate, and recycling operations. EPA will foster workshops for manufacturers and educators to promote the design of products and packaging for effective waste management. EPA will identify economic, regulatory and possibly legislative incentives for decreasing the volume and toxicity of waste. EPA will also take steps to facilitate Federal procurement of products with source reduction attributes. Industry should conduct waste audits, and determine ways to decrease the volume and toxicity of materials used in manufacture.

Recommendations for recycling (including composting) call for fostering implementation of existing Federal procurement guidelines (as well as evaluating ones for additional commodities), and creating an interagency working group to develop pilot and full-scale projects for separating recyclables in Federal agencies. Markets for secondary materials and recycled goods must be stimulated and stabilized; thus EPA will conduct market development studies for different commodities, will examine economic and regulatory incentives for using secondary or recycled materials, and will foster the formation of regional marketing councils for the exchange of market information. A National Recycling Council will be formed with members from all sectors of waste management to track recycling issues and problems and to recommend actions. Finally, EPA will study how to foster recycling lead-acid batteries, including examining the current incentives and disincentives associated with liability. Industry should step up its efforts in fostering the recycling of plastics. State and local governments should encourage separation of recyclables, conduct waste exchanges, and provide incentives for stable markets for recycled goods.

Finally, recommendations for decreasing the risks from landfilling and combustion include continuing EPA's ongoing efforts to develop air emission standards for new combustors and landfills, air emission guidelines requiring state standards for existing combustors and landfills, and revised minimum design and operation criteria for landfills. EPA recommends that ash management plans be developed as part of any plan for combustion of waste. EPA, in conjunction with trade associations, will facilitate development of guidance on training and certification for combustor and landfill operators. EPA will also study whether bans are necessary or desirable for certain types of waste.

These recommendations present a core program for governmental, industrial and citizen action which will help solve our nation's municipal waste management problems.

(The complete report is held in the committee files.)

United States
Environmental Protection
Agency

Office of Municipal
Pollution Control (WH-595)
Washington, DC 20460

Office of Water

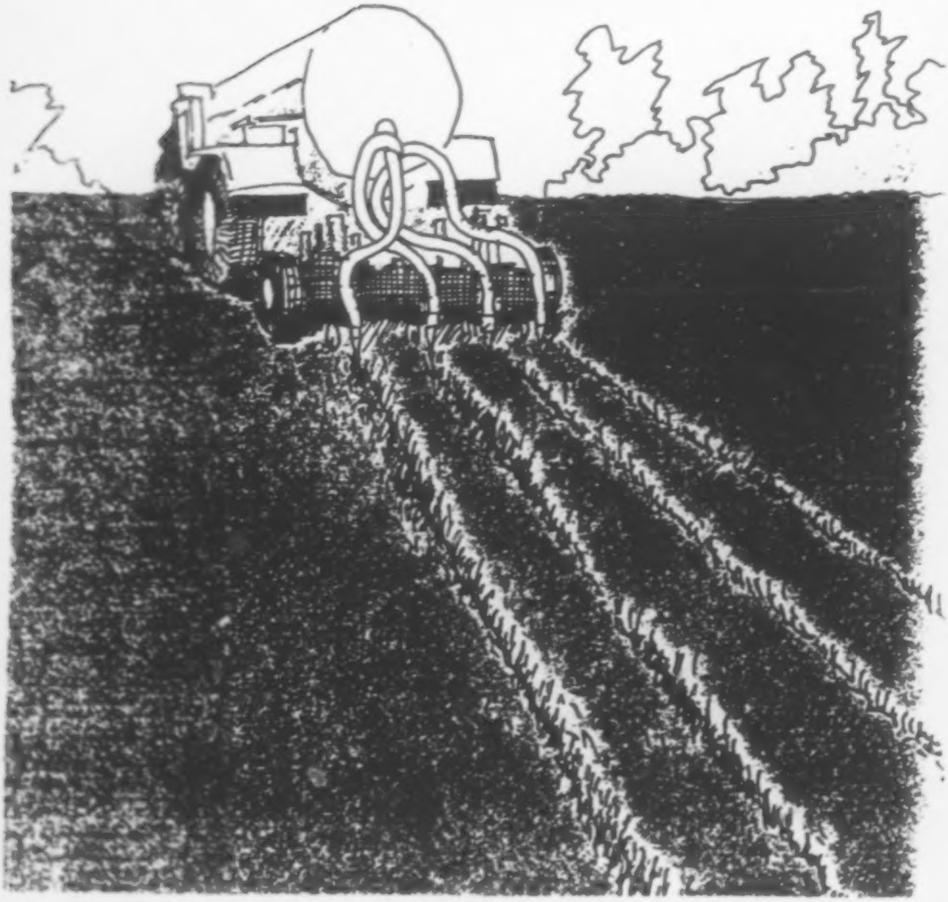
June 1989

EPA

EPA's Policy Promoting The Beneficial Use Of Sewage Sludge

and

The New Proposed Technical Sludge Regulations



OVERVIEW

- The U.S. Environmental Protection Agency (EPA) will continue to promote municipal sewage sludge management practices that provide for the beneficial use of sewage sludge while maintaining or improving environmental quality and protecting human health.

- Thousands of municipalities are currently land applying or otherwise recycling their sewage sludge. Both agricultural and non-agriculturial sites benefit from the use of sewage sludge, which typically contains $50 to $60 of nutrient and soil conditioning value per ton. Sewage sludge has been successfully used in the production of many different food, feed, and horticultural crops, in sod production and turf maintenance, in the management of forest production, as well as in reclaiming and revegetating areas disturbed by mining, construction, and waste disposal activities.

- Sludges should be adequately stabilized prior to use on land. This can be accomplished by digestion, chemical stabilization, or other means. A potential benefit from anaerobic digestion is the recovery of methane gas from the digestion process which can be used as a fuel source.

- EPA proposed new technical standards to govern the use and disposal of sewage sludge on February 6, 1989, and is seeking public comment and data for their improvement. Comments must be received by August 7, 1989.

- These proposed standards may change based upon the Agency's data gathering initiatives and the comments received. Therefore, EPA advises permit writing authorities and others not to rely on the proposed standards as a basis for evaluating the safety of proposed sludge management projects or establishing appropriate requirements for sludge use and disposal. EPA intends to carefully weigh the extent to which the proposed standards should be used, and appropriate advice will be given in the revised "Guidance for Writing Case-By-Case Permit Requirements for Municipal Sewage Sludge" scheduled for later this year.

- The proposed technical standards can be used to gain an understanding of the types of practices and kinds of pollutants that may be regulated when the revised standards are promulgated.

Purpose

The U.S. Environmental Protection Agency published the "Proposed Standards for the Disposal of Sewage Sludge" in the *Federal Register* (Volume 54, No. 23, pp. 5746-5902) for public comment on February 6, 1989. This brochure helps clarify the purpose of the new proposed sewage sludge standards and reaffirms the Agency's policy of encouraging beneficial use of sewage sludge. This publication also describes current Federal and State requirements that will govern sludge use and disposal practices until the new technical sludge regulations are promulgated in final form.

EPA Policy on Beneficial Use of Municipal Sludge

EPA's official "Policy on Municipal Sludge Management" (49 *FR* 24358, June 12, 1984) states that:

"The U.S. Environmental Protection Agency (EPA) will actively promote those municipal sludge management practices that provide for the beneficial use of sludge while maintaining or improving environmental quality and protecting public health. To implement this policy, EPA will continue to issue regulations that protect public health and other environmental values... Local communities will remain responsible for choosing among alternative programs; for planning, constructing, and operating facilities to meet their needs; and for ensuring the continuing availability of adequate and acceptable disposal or use capacity."

(The complete report is held in the committee files.)

STATEMENT OF

DR. R.L. CHANEY

AGRICULTURAL RESEARCH SERVICE

U.S. DEPARTMENT OF AGRICULTURE

Mr. Chairman and Members of the Committee, it is a pleasure to appear before you today. I am Dr. Rufus L. Chaney, a Research Agronomist in the Soil-Microbial Systems Laboratory, Agricultural Research Service, U.S. Department of Agriculture. I am accompanied by Dr. W. Doral Kemper, National Program Staff, Agricultural Research Service, U.S. Department of Agriculture. Since 1971, I have worked in this laboratory and its predecessors which were engaged in research on composting of sewage sludge and safe methods to utilize sewage sludge and sludge compost.

As the Subcommittee knows, USDA-Agricultural Research Service (in cooperation with the Environmental Protection Agency, the State of Maryland, Washington, DC, the Washington DC Council of Governments, the Maryland Environmental Service, The University of Maryland, and the Washington Suburban Sanitary Commission) successfully conducted research on composting of sewage sludge during the period 1972 to 1982. This research was so successful that the private sector is developing specific marketable technologies to compost sewage sludge. Over 200 publicly-owned treatment works have started work on composting.

The acceptance of composting by U.S. cities was based on both the practicality of the sludge processing technology known as the Modified Beltsville Method, and on the basic research which provided both a basis for Federal and State regulation of composting and marketing of sludge compost, and specific recommendations for beneficial uses of compost. Sludge composting would have remained a scientific curiosity if the basis for using sludge compost and for regulating sludge compost marketing had not been developed along with the method to make the compost. This work involved 1) determining the conditions to obtain stabilization of the compost to obtain slow release of fertilizer nutrients and to avoid malodors; 2) determining the conditions required for composting to kill pathogenic organisms; 3) determining the fertilizer benefit of applied compost in fields, gardens, and yards; 4) showing the benefit of sludge compost in horticultural potting media; 5) characterizing the fate and effects of microelements and heavy metals in compost, including effects on plants (fertilizer benefit and potential toxicity), transfer to edible plant parts, and potential for effects on livestock and humans; and 6) beginning research on fate and effects of potentially toxic organic compounds during composting and through compost utilization. The results of this extensive research program (and related research at other ARS laboratories, and at the State Universities cooperating within the USDA-CSRS system) provided a major part of the basis for development of State and Federal regulations which facilitated use and protected the environment from misuse of sewage sludge and sludge compost.

Identifying and developing "bulking agents" and processes for co-composting them with sewage sludge to provide aeration and energy during the composting and curing processes was a significant part of the ARS-Beltsville sludge related research during the 1970's. Materials found suitable as "bulking agents" included wood chips, leaves, straw, other crop residues, and air-separated refuse (usually called RDF, refuse derived fuel). RDF (both pelletized and loose) was obtained from the demonstration separation facility at Cockeysville, MD. When sludge was mixed with RDF in appropriate proportions, the mixture composted well. The biodegradable organic portion of municipal solid waste, which makes up most of the RDF, is generally a good bulking agent for composting sewage sludge. The pelletized RDF material was somewhat more successful as a bulking agent because the loose non-pelletized material (primarily paper) tended to collapse upon wetting and an additional bulking agent such as wood chips was needed to maintain proper aeration during composting. Co-composting has been used by many European cities for decades. The difficulty with co-composting separated refuse is not in the composting technology per se, but in producing a predictable beneficial product which will be accepted by horticultural and agricultural users.

The best means for separation and recovery of non-degradable materials from the resulting compost mixture have been evaluated in pilot tests over the years. In general, these tests have indicated that the best approach to composting or co-composting solid waste is to separate the solid waste before initiating composting. When mixed solid waste is shredded, composted, and then separated, the "compost" product contains higher levels of heavy metals and glass than when the solid waste is separated before composting. This metal and glass content reduces consumer acceptability. Grinding the product of composting to minimize the visibility of glass, plastic, and other non-degradable materials has been proposed. Although glass, heavy metals and plastics in compost prepared by methods using post-composting separation or compost grinding may not cause environmental problems, they unnecessarily detract from the value of the compost. Solid waste compost or co-compost prepared with pre-separation of glass, metals, and plastics is clearly more acceptable to consumers.

Research conducted on fate and effects of heavy metals and organics in sludges have provided information needed as guidelines for safe and successful solid waste composting or co-composting. If sludge is to be co-composted with separated solid waste, research has shown that only sludges low in toxic constituents should be used. The higher the concentration of metals or toxic organics in a sludge, the higher the potential for food-chain transfer or toxicity to plants. Thus, some limits on the quality of sludges used in co-composting would be advisable. Pretreatment of industrial effluents to recover metals at the source has been a very successful means for reducing concentrations of heavy metals in municipal sludges. Sludges and resultant sludge composts with low concentrations of heavy metals have been much more acceptable to the agricultural community since researchers and farm advisors can assure growers that risks from these high quality sludges are very low.

Refuse-sludge co-composts can significantly benefit the United States in several ways. One is reduction of need for landfill disposal of solid waste. Another is reduction of mining of peat. Composts are used as an alternative to peat, and the composts usually contain significantly higher levels of many nutrients than does peat. Composts replace peat in potting media and as soil conditioner, saving both the cost of new materials (virgin peat) and transport of the peat to the user. Substantial amounts of the peat used in the U.S. are imported.

The Department does not recommend enactment of Section 5 of H.R. 500. We would defer to other agencies for comments on the other sections. Handling of sludge and refuse has traditionally been the responsibility of the Environmental Protection Agency within the Federal Government. However, several issues are considered in the bill which would be of interest to the Department of Agriculture. As noted above, substantial research on sludge-refuse co-composting was completed and has been published. However, one significant impediment to adoption of this technology is the lack of adequate research results on co-compost utilization and benefits in horticulture and agriculture. Similarly, insufficient information exists to develop all the regulations needed to protect the environment and food-chain during co-compost utilization. Research on these questions cannot be completed in one year, because decomposition of composts and release of nutrients and metals therefrom are slow processes which are dependent on soil and compost characteristics, water content, and management practices. The technology to optimize production of co-composts and optimize their utilization have not been developed. It took more than a decade to provide the extensive national research base about sewage sludge utilization which now provides the basis for regulations and for public recommendation to growers. The one year reporting deadline proposed in this bill would not allow sufficient time to conduct research on co-composting or on safe and beneficial co-compost utilization. Such research is needed to develop guidelines to assure safe and optimal use and to gain public acceptance and support of this major change in the way solid waste is managed in the U.S.

Many publications were prepared by USDA-ARS reporting research on composting and on sludge and compost utilization. Two are especially important to this Subcommittee. These are 1) the Manual for Sludge Composting, and 2) the Bulletin on Sludge Compost Utilization. These documents communicate the results of research to users, be they EPA, States, Cities, POTWs, Companies who want to manufacture composting equipment, or users of sludge compost. Lists of publications from the Beltsville, MD, and St. Paul, MN, USDA-ARS laboratories which conducted intensive research on sludge composting and on sludge and compost utilization are also available for the Subcommittee.

Mr. Chairman, this completes my prepared statement. We would be pleased to respond to questions.

United States
Department of
Agriculture

Agricultural
Research
Service

Agriculture
Information
Bulletin
Number 464

Utilization of Sewage Sludge Compost as a Soil Conditioner and Fertilizer for Plant Growth

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This publication contains the results of research only. Mention of a chemical product does not constitute a recommendation for use by the U.S. Department of Agriculture. The use of trade names in this publication does not imply a guarantee or endorsement of the product by the Department over other products not mentioned.

This publication is a revision of and supersedes Agricultural Reviews and Manuals, Northeastern Series, No. 6, "Use of Sewage Sludge Compost for Soil Improvement and Plant Growth."

Copies of this publication can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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Agricultural Research Service has no additional copies for free distribution.

Issued August 1984

SUMMARY AND CONCLUSIONS

Composts made from sewage sludges that are low in their content of heavy metals and toxic organics can be used safely and beneficially as soil conditioners and fertilizers. These benefits are largely dependent on the quality of the sludge, the bulking material used, and the degree of stabilization achieved during the composting process. Research has shown that good-quality sewage sludge compost can be used as a valuable amendment in the production of agricultural and horticultural crops; in the establishment, maintenance, and production of turfgrasses; in the formulation of potting media for nursery production; in vegetable gardens; and in the reclamation of marginal and disturbed soils. Since State and local laws governing the use of sewage sludge compost are variable, specific details concerning its utilization should be obtained from appropriate municipal, county, or State regulatory agencies.

This bulletin provides information on how sewage sludge compost can be used most effectively. Recommendations are based on a decade of research involving many laboratory, greenhouse, and field experiments. Because the type of sewage sludge and bulking material affects the quality of the final product, it is essential that the source and composition of these materials be known prior to composting and certainly before using the product.

The greatest benefit from compost usually can be achieved at relatively low applications of 10 to 20 mt per hectare, a level that generally would improve soil physical properties, such as decreased bulk density and surface crusting, and increased water infiltration, permeability, aeration, and water-holding capacity. Economic analyses have also shown that small additions annually are more profitable for the farmer than a single one-time, large application. Land reclamation projects on disturbed and marginal land are exceptions, since one-time, large applications of 100 to 200 mt per hectare are necessary to overcome the inherent, adverse, chemical and physical conditions that prevent the establishment and growth of plants.

Although substantial research data are available on the use of sewage sludge compost, several areas need to be further researched, such as the residual fertilizer value of compost, long-term effects on soil physical properties, ability of composts to suppress soil-borne diseases, availability of organically bound heavy metals with time, development of suitable analyses or bioassays to monitor composts for harmful constituents, improvement of composting technology to insure a uniform, stable product, and more accurate estimates of the long-term economic benefits of using sewage sludge compost. Although further research is needed, the information to date demonstrates the many benefits that can be derived from using good-quality sewage sludge composts in agriculture, horticulture, and land reclamation.

(The complete report is held in the committee files.)

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MANUAL FOR COMPOSTING SEWAGE SLUDGE BY THE BELTSVILLE AERATED-PILE METHOD

by

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FOREWORD

The U. S. Environmental Protection Agency was created because of increasing public and governmental concern about the dangers of pollution of air, water, and land to the health and welfare of the American people. Its personnel are charged with the responsibility of alleviating, correcting, and when possible preventing problems of that nature.

The U. S. Department of Agriculture is broadly concerned with all aspects of U. S. agriculture. Its personnel endeavor to facilitate the efforts of the U. S. farmer to supply food and fiber to populations at home and abroad, but always with the minimum practical hazard to the environment.

The work here reported was aimed at the furtherance of the purposes of both agencies. It originated from an urgent need of both large and small municipalities for better methods to dispose of ever-increasing amounts of sewage sludge. Composting offers a double-barreled solution to that problem. It not only disposes of sludge but also converts it into a product which is more aesthetically acceptable, safer from a health standpoint, and useful in many important practical applications as a soil amendment beneficial to the growth of plants. The present manual discloses details of the Beltsville Aerated Pile Method of Composting sewage sludge. Research conducted at Beltsville by USDA in cooperation with the Maryland Environmental Service with the support of EPA, has shown that composting is a cost-effective and environmentally acceptable alternative to such ultimate disposal methods as incineration, ocean dumping, and landfilling.

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PREFACE

In the early 1970's, the Blue Plains Wastewater Treatment Plant in Washington, D.C., serving seven jurisdictions, was producing about 300 wet tons (23% solids) of digested sludge per day. Construction for advanced wastewater treatment facilities displaced existing sludge storage. Disposing of the sludge by discharging it into the Potomac River or barging it for off-shore dumping into the Atlantic Ocean were both rejected as environmentally unacceptable. The consulting firm of Metcalf and Eddy, Inc. recommended sludge incineration as the best disposal system for Blue Plains. Until the incinerators could be constructed, the Maryland Environmental Service (MES), assumed the responsibility for disposing of the sludge by land application.

In 1971, the Biological Waste Management Laboratory at the U.S. Department of Agriculture's Beltsville Agricultural Research Center initiated research on land application of sludge in cooperation with MES and the Metropolitan Washington Council of Governments. Several methods were investigated, including trenching and landspreading. In 1972, at the request of MES and the Blue Plains participants, this Laboratory began research on composting of sewage sludge. By early 1973, a successful windrow method utilizing woodchips as a bulking and moisture-absorbing agent had been developed for composting digested sludge. During 1973 and 1974, the Beltsville facility windrow composted in excess of 50 wet tons of digested sludge each day (Figure 1).

By 1975, the Blue Plains Wastewater Treatment Plant had increased its capability for removal of solids from the wastewater. This resulted in the production of an additional 200 wet tons of undigested or raw sludge (a mixture of primary and activated secondary sludges), for a total output of about 500 wet tons of sludge per day. Meanwhile, digestion capacity remained at 300 tons per day.

Difficulties were encountered when the windrow method was applied to raw sludge, because of the greater level of malodors associated with this type of sludge. Moreover, raw sludge generally contains a higher level of pathogens and there was concern that some of these organisms might survive in the outer layers of the windrow, where temperatures would be lower. The need for disposal of the raw sludge resulted in the development of the composting process now referred to as the Beltsville Aerated Pile Composting Method described in this manual.

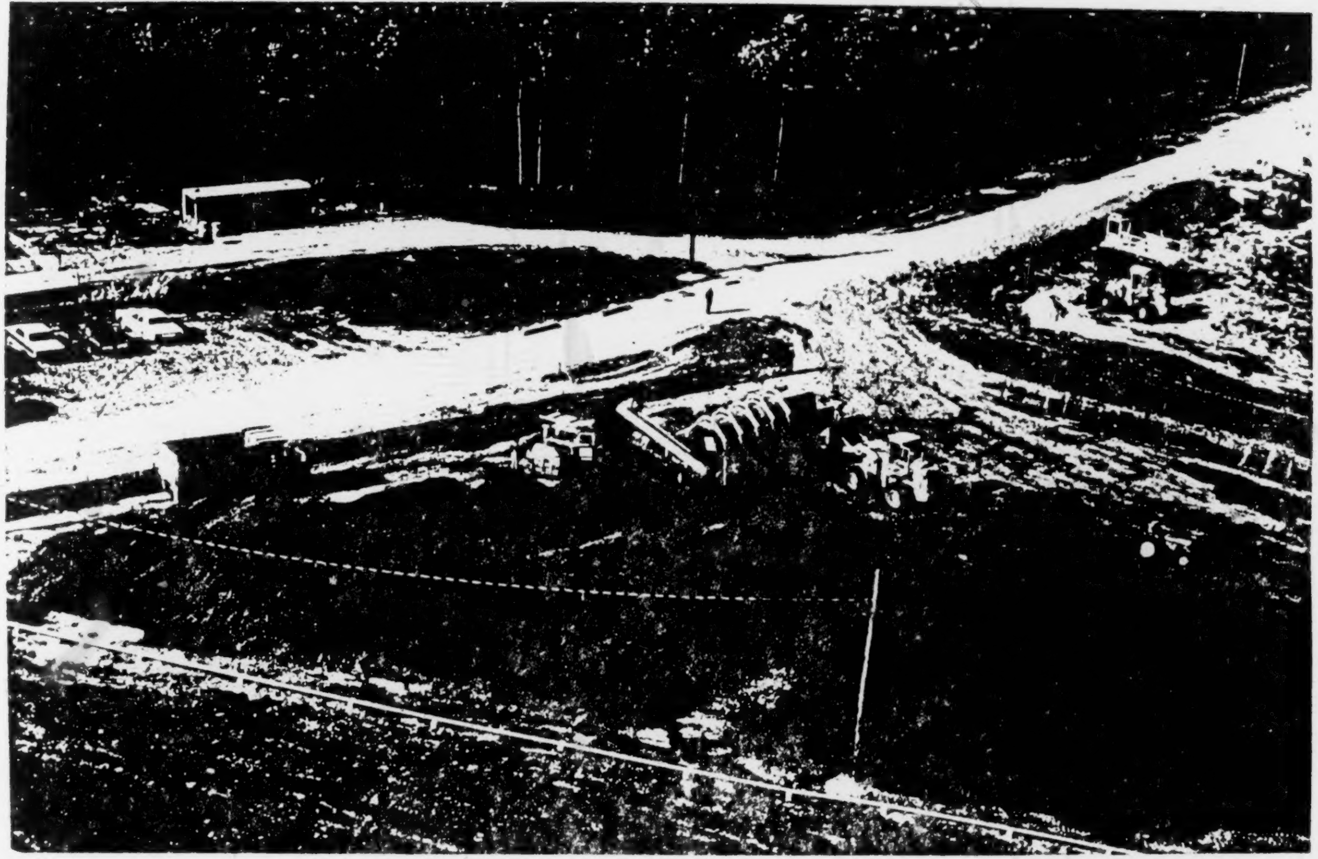

Figure 1. Screening woodchips from sewage sludge compost for recycling, Beltsville, 1973. Stock pile of screened compost in left foreground. Air-dried compost before screening in right foreground.

The Environmental Protection Agency has issued a deadline of 1981 or sooner to cities that are presently ocean dumping their sludge to cease using that method of disposal. This manual was developed for the assistance of those sewage authorities that must find acceptable new outlets for their sludge on short notice. The manual has been written during the early stages of research; improvements can be expected as development continues and communities adopt the process.

ABSTRACT

In producing clean water from sewage, wastewater treatment plants also produce sludge. Most of the commonly used methods to dispose of this material are now considered to be either environmentally unacceptable, wasteful of energy, or very expensive. To ease this situation, a relatively simple, rapid, and inexpensive sludge composting process has been developed at Beltsville. The method makes possible the conversion of undigested sludge into a composted product that is aesthetically acceptable and meets environmental standards. The material has demonstrated usefulness as a soil amendment stimulative to plant growth. If relatively simple control procedures are followed, the compost appears to be free of primary human pathogens because of the lethal effect of heat generated during the composting process on such organisms.

The new Beltsville composting procedure, detailed here in respect to both principles and practice, represents a major advance over previously known composting methods. It is adaptable to practical use in municipalities of widely varying size. In many situations its short startup time will allow its use as an emergency interim solution for sludge management. Key information is presented on the economics of the process, and on the marketing and use of the product as a soil conditioner to improve plant growth.

This report was submitted in partial fulfillment of Grant No. S803468 by the Maryland Environmental Service under sponsorship of the U.S. Environmental Protection Agency. Work was done under subcontract by the U.S. Department of Agriculture. This report covers the period July 1975 to December 1977, and work was completed as of June 1978.

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(The complete report is held in the committee files.)

NORA GOLDSTEIN

Executive Editor, BioCycle Magazine

Thank you for the opportunity to provide testimony on Section 5 of H.R. 500, the "Recyclable Materials Science and Technology Development Act of 1989." I am Nora Goldstein, Executive Editor of BioCycle magazine. BioCycle, the Journal of Waste Recycling, has been published since 1960, originally under the name, Compost Science.

I have been asked by the Subcommittee to discuss several different areas related to composting. These are:

1. The current status of composting in the United States, including a summary of the associated risks and benefits;
2. The potential future of composting; and
3. A review of Section 5 of H.R. 500, including recommendations for possible incorporation into the bill.

STATUS OF COMPOSTING

MSW COMPOSTING: BioCycle conducts annual surveys of composting projects in the United States. We recently completed the annual survey of municipal solid waste (MSW) composting projects, and are in the process of conducting the 1989 survey of sewage sludge composting facilities. Attached for the record is the 1989 list of MSW composting projects. I have also included a copy of the 1988 listing of sludge composting projects.

As of October 1989, BioCycle found 75 solid waste composting projects in various phases of development, ranging from consideration to operational. We found seven full-scale operational projects ranging in size from a 10 ton/day facility in Lake of the Woods, Minnesota to the project in Delaware that co-composts 350 tons/day of processed MSW with 70 dry tons/day of municipal sewage sludge. There are two other MSW composting projects in construction, one of which is designed to compost 800 tons/day of MSW. In addition, there are four other projects expected to start construction in the near future.

Because Section 5 of H.R. 500 specifically addresses the initiation of a pilot project to demonstrate the viability of co-composting of MSW and sewage sludge , I would like to discuss our findings in that area. Of the 75 MSW projects in the 1989 listing, about 20 projects do include or plan to include sewage sludge or septage in the composting system. There are five pilot projects that are either ongoing at this time or which will be underway by the first part of next year. Of these five, four are testing the composting of sludge and MSW; the fifth project is utilizing septage.

Finally, with regard to MSW composting, it is interesting to note that the 1988 BioCycle survey found 42 solid waste composting projects in various stages of development or in operation. Thus the growth in solid waste composting activity has almost doubled since last year, from 42 to 75.

SEWAGE SLUDGE COMPOSTING: Our 1988 survey of sewage sludge composting facilities found 219 projects in various stages of development or operation. (Some of these projects, because they include solid waste, are also listed in the MSW composting survey.) Of the 219, there were 115 sludge composting projects in operation, with 14 in construction and 40 in the planning design or bid stages. There were also 14 pilot projects. Preliminary tabulations from BioCycle's 1989 survey show that there will be well over 200 projects listed again.

A variety of methods are used to compost sewage sludge. At this time, the aerated static pile technology -- which was pioneered by research at the U.S. Department of Agriculture's research facilities in Beltsville, Maryland -- is the overall leader (representing 61 of the 115 operating projects). There are increasing numbers of in-vessel systems going into operation, and a number of municipalities and counties utilizes the more simplified windrow composting method.

The growth in the number of sludge composting facilities also has been significant. In 1983, the first year a survey of sludge composting projects was conducted, there were 61 facilities operating. In 1985, there were 79; in 1986 there were 89; and in 1987 there were 107.

YARD WASTE COMPOSTING: Before I get into discussing trends and the future of composting, it is important to point out one very significant development: the composting of yard waste, which includes leaves, brush, grass clippings and other land clearing and landscaping wastes. About a year ago, while conducting a survey of state waste management practices, BioCycle found 650 operating yard waste composting projects. Given state bans on landfilling yard waste, we expect to see a minimum of 2,000 yard waste composting facilities in operation within the next five years. We believe that this growth in yard waste composting projects will lead to greater growth in composting other separated fractions of the solid waste stream, such as household organic food waste. In addition, there are a growing number of sludge composting projects that have begun using yard waste as a bulking agent.

RISKS AND BENEFITS

Given the current level of activity, combined with trends that create a positive climate for the development of new projects, BioCycle is indeed bullish about the future of composting. But while we are bullish, we are also realistic, and composting, like all waste management options, has its limitations. I'd like to briefly review some risks and benefits, and will try to limit my comments to co-composting of municipal solid waste and sewage sludge.

1. Quality of the Compost Product: In theory, a major benefit of composting -- besides stabilization of the waste and volume reduction -- is that the process yields a valuable end product. Given a quality feedstock and the right processing -- before, during, and after composting -- composting MSW and sewage sludge can produce a marketable, quality compost product.
But depending on the targeted end use for the compost, quality may not be a critical issue. For example, some projects view composting as a way of reducing the volume of MSW that has to be landfilled. Others only plan to use the end product as a landfill cover, thus are not concerned about particles of glass, plastic and metal in the compost. The majority of facilities, however,

target or plan to target higher end uses for the finished compost, such as landscaping and horticultural markets, public works applications, and agricultural applications. In these cases, quality of the end product is a critical issue and is a determining factor in how the composting facility is designed and operated. Problems can occur when the quality does not meet the demand of targeted markets.

2. Contaminants: The composition of the solid waste stream is such that there is great potential for contamination of the compost product. Even with a high degree of physical separation, where glass, metal and plastics are removed via source separation by residents, and hand-picking and mechanical separation at the plant, the potential exists for pieces of those materials to remain in the finished compost. The technology exists to further remove those materials by fine-screening or grinding of the final product. (It should be noted that reliance on fine processing at the back-end of the system -- versus greater separation prior to actual composting -- will most likely result in greater residuals that have to be landfilled.) Concern also exists with regard to chemical contamination from various toxics in the solid waste stream.

Sewage sludge can have unacceptable levels of heavy metals and organics that also raise concerns with regard to utilization of the end product. Mechanisms such as industrial pretreatment are in place to minimize pollutant content of the sludge. There are many examples of industrialized cities that have instituted pretreatment programs and now have successful beneficial use programs. And there has been ongoing research with regard to the fate of these pollutants when sewage sludge is beneficially used.

The potential exists to have a fairly clean MSW feedstock going into the composting facility just by use of source separation at the household or commercial establishment. In addition, processing systems and technologies at the facility allow for further separation of physical contaminants. Risks from chemical contaminants can be reduced by establishment of household hazardous waste collection programs, combined with education of citizens and businesses about keeping toxics out of the waste stream. In short, with both sewage sludge and municipal solid waste, the potential does exist to minimize contaminants and thus minimize the risks from compost utilization. This capability must be combined with state and federal regulations that set pollutant limits and establish guidelines for utilization of the finished compost.

3. Process Control: Operators of solid waste and sludge incinerators have to constantly deal with finicky machinery and system breakdowns. While some composting systems are mechanically intensive, a great deal of the success with composting revolves around management of the biological process, not machinery. These process controls are critical to ensure destruction of pathogenic organisms and to maximize stabilization, as well as to minimize the generation of odors and vector attraction. The research conducted by USDA in Beltsville, as well as at places like Rutgers University and the Sanitary Engineering Research Laboratory in Berkeley, California, all greatly contributed to outlining the principles and necessary procedures for composting. These principles underlie the process controls. Establishment of

principles is not a stagnant process -- and is one that would directly benefit from a pilot co-composting research project.

4. Vendor-Driven Option: There are more than 30 vendors of systems for composting MSW and sewage sludge. All of these companies and their licensees are very actively marketing their technologies to cities, counties, and states. The obvious benefit of this commercial activity is that there are numerous options available for composting. The primary downside -- and risk -- is that the vendors and their willingness to get projects up and running is driving the development of solid waste composting before enough research and development has been completed. On the one hand, having projects operating gives others an opportunity to learn. It is difficult, however, to obtain independent, scientific analyses and to critically examine the various approaches to composting. The research conducted on sludge composting by USDA helped to create that independent body of knowledge that wastewater treatment plant operators use to design projects. In this current generation of interest in solid waste composting, there is a critical need for that type of information.

FUTURE OF COMPOSTING

There are a number of trends that are creating an encouraging environment for the development of co-composting projects. The momentum is being fueled by a number of factors: diminishing or non-existent landfill capacity; anti-incineration sentiments; state solid waste management policies and regulations that encourage composting; cost-competitiveness of this option with other alternatives; and the compatibility of composting with recycling programs in an integrated waste management program. In addition, the U.S. Environmental Protection Agency's recently adopted Part 258 landfill regulations will make it difficult and costly for many landfills to remain open. In many of these areas, with a lack of markets for energy from incinerators and a small population base, composting appears to be the only viable alternative.

Several other trends are encouraging the development of composting projects. These include efforts by states to protect groundwater (leading to the closure of landfills) and the encouragement of sustainable farming practices (also to protect groundwater) that could lead to greater utilization of organic materials to build up the soil and reduce use of chemical fertilizers. Because the closure of rural landfills is often in agricultural areas, development of composting projects should create valuable soil amendments for depleted soils. Finally, one trend that has been driving the growth of sludge composting projects is the development of land that traditionally had been used for the direct land application of sewage sludge. Wastewater treatment plants are forced to find sites further away from their facilities (driving up hauling costs), and in many cases, get into public acceptance problems due to hauling a waste product outside of their jurisdictions. In these cases, composting provides treatment plants with more flexibility to manage their sludge.

For the above reasons, and more (such as growing acceptance of the use of composted products), we feel confident in saying that the future looks good for composting -- as long as the risks mentioned above are taken into account. States have played a very active role in encouraging the development of composting projects, and a number of state agencies provide grant assistance. More and more municipalities and counties are mandating or encouraging the separation of organics from the waste stream for composting, creating high quality feedstocks. There is, however, one black cloud on the horizon -- EPA's proposed Part 503 technical regulations for the management of sewage sludge which if adopted as proposed, would make it difficult for beneficial use programs to operate. The public comment period for the sludge management regulation closed on August 7, 1989 and the comments were overwhelmingly critical, in many cases calling for complete reproposal of the rule.

COMMENTS ON SECTION 5

BioCycle encourages the involvement -- once again -- of the U.S. Department of Agriculture in composting research. Since 1982, when USDA halted its involvement, the interest in composting solid waste and sewage sludge has grown immensely. The timing for such involvement could not be better, and the need for this kind of independent research is critical. I have the following specific comments on Section 5 of H.R. 500:

1. Time Frame: A research project of this kind may require more than one year to obtain the kind of information needed. For example, the generation of a quality compost itself may take about six months; this end product then needs to be analyzed and used in various applications, e.g. agricultural and horticultural uses. These kinds of experiments take more than one year to conduct. If funding is only available for one year of research, one suggestion might be for USDA to coordinate with ongoing pilot co-composting projects and perhaps focus on just one aspect of the research, e.g. end product analyses and applications.

2. Compost Feedstocks: Section 5, (b)(1) discusses composting of "municipal garbage and other solid waste...." The "other solid waste" portion of that language holds great potential as there also is growing interest in composting such materials as agricultural residues (including manures), food processing wastes, supermarket green wastes, etc. USDA's research involvement with some of these other feedstocks would be very timely.

3. Separation of Nondegradables: Section 5 (b)(2) discusses the separation of nondegradable materials from the resulting compost mixture. While it is important to analyze the levels and kinds of residuals after composting, it is much more practical to recover these materials on the front-end of the system -- prior to composting. From a physical separation standpoint it is easier to remove recyclables prior to composting. In addition, the quality of these recyclable materials will be higher if they are removed before composting. It would be interesting for the pilot project to compare the two approaches (removing recyclables prior to composting versus after) because both approaches are being marketed at this time. However, if USDA is limited in its research, we would suggest that the time would be better spent focusing on how to maximize upfront separation to better improve the quality of the final compost.

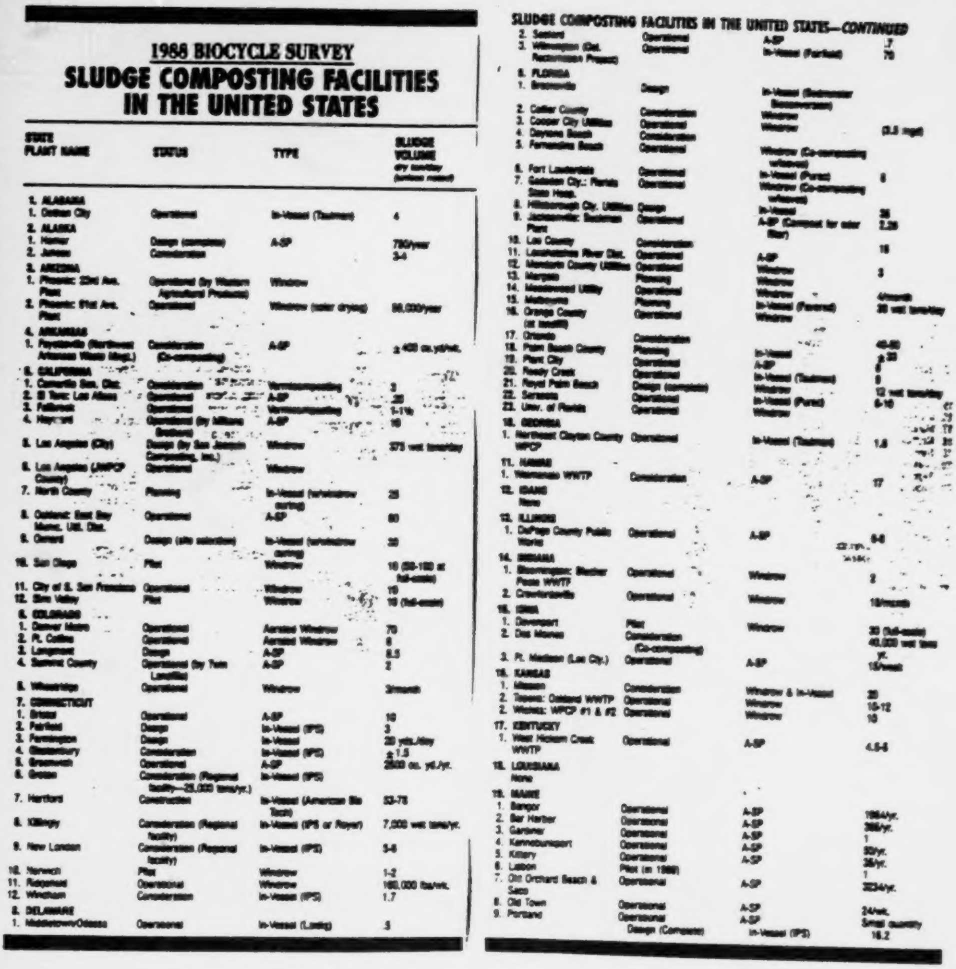
4. Agricultural Uses: We strongly encourage USDA to research agricultural applications for co-composted products. Over the last 15 years of sludge composting, we have found that the primary markets for sludge compost have been horticultural, landscaping and public works applications -- and not agriculture. USDA research in this area would be exceptionally useful and could lay the groundwork for applications of a variety of composted products in the future.

Expanding the language on agricultural utilization to specify greenhouse and field testing of the finished compost (as well as extensive laboratory analyses on the end product) may help to insure that the USDA pilot project would conduct this research. This kind of "third party" information builds end user confidence, which is critical to the success of any compost utilization program (i.e. where the targeted end use is other than landfill cover applications).

CONCLUSION

In closing, I would like to reemphasize that the composting research outlined in Section 5 of H.R. 500 is timely and needed. In the absence of federal involvement in composting research over the last seven years, some states have created grant programs to finance pilot projects. However, given the level of interest in composting -- and the role of composting in integrated waste management solutions -- BioCycle believes there is a critical need for more research -- the kind that taps into the knowledge and resources available at USDA's research laboratories. In addition, there needs to be a better developed link between generation of compost products and agricultural utilization. The kind of research project suggested in H.R. 500 would be an excellent starting point for that development to occur. Finally, USDA's contribution to the development of composting cannot be stated strongly enough. It gave wastewater treatment plant operators a "package" of information to use to get sludge composting projects underway. Clearly, USDA's involvement in co-composting research will help to provide that kind of information, again -- contributing to the further development of composting in the United States.

(Attachments follow:)



1988 BIOCYCLE SURVEY

SLUDGE COMPOSTING FACILITIES IN THE UNITED STATES

STATE PLANT NAME	STATUS	TYPE	SLUDGE VOLUME dry tons/day (unless noted)
1. ALABAMA			
1. Dothan City	Operational	In-Vessel (Taulman)	4
2. ALASKA			
1. Homer	Design (complete)	A-SP	750/year
2. Juneau	Consideration		3-4
3. ARIZONA			
1. Phoenix: 23rd Ave. Plant	Operational (by Western Agricultural Products)	Windrow	
2. Phoenix: 91st Ave. Plant	Operational	Windrow (solar drying)	86,000/year
4. ARKANSAS			
1. Fayetteville (Northwest Arkansas Waste Mngt.)	Consideration (Co-composting)	A-SP	≥400 cu.yd/wk.
5. CALIFORNIA			
1. Camarillo San. Dist.	Consideration	Vermicomposting	3
2. El Toro: Los Alisos	Operational	A-SP	.25
3. Fallbrook	Operational	Vermicomposting	1-1½
4. Hayward	Operational (by Millens Brothers)	A-SP	10
5. Los Angeles (City)	Design (by San Joaquin Composting, Inc.)	Windrow	375 wet tons/day
6. Los Angeles (JWPCP County)	Operational	Windrow	
7. North County	Planning	In-Vessel (windrow curing)	25
8. Oakland: East Bay Munic. Util. Dist.	Operational	A-SP	60
9. Oxnard	Design (site selection)	In-Vessel (windrow curing)	30
10. San Diego	Pilot	Windrow	10 (50-100 at full-scale)
11. City of S. San Francisco	Operational	Windrow	15
12. Simi Valley	Pilot	Windrow	10 (full-scale)
6. COLORADO			
1. Denver Metro	Operational	Aerated Windrow	70
2. Ft. Collins	Operational	Aerated Windrow	6
3. Longmont	Design	A-SP	8.5
4. Summit County	Operational (by Twin Landfills)	A-SP	2
5. Wheatridge	Operational	Windrow	3/month
7. CONNECTICUT			
1. Bristol	Operational	A-SP	10
2. Fairfield	Design	In-Vessel (IPS)	3
3. Farmington	Design	In-Vessel	20 yds./day
4. Glastonbury	Consideration	In-Vessel (IPS)	±1.5
5. Greenwich	Operational	A-SP	2500 cu. yd./yr.
6. Groton	Consideration (Regional facility—25,000 tons/yr.)	In-Vessel (IPS)	
7. Hartford	Construction	In-Vessel (American Bio Tech)	53-75
8. Killingly	Consideration (Regional facility)	In-Vessel (IPS or Royer)	7,000 wet tons/yr.
9. New London	Consideration (Regional facility)	In-Vessel (IPS)	5-8
10. Norwich	Pilot	Windrow	1-2
11. Ridgefield	Operational	Windrow	160,000 lbs/wk.
12. Windham	Consideration	In-Vessel (IPS)	1.7
8. DELAWARE			
1. Middletown/Odessa	Operational	In-Vessel ([illegible])	.3

SLUDGE COMPOSTING FACILITIES IN THE UNITED STATES—*CONTINUED*

STATE PLANT NAME	STATUS	TYPE	SLUDGE VOLUME dry tons/day (unless noted)
2. Seaford	Operational	A-SP	.7
3. Wilmington (Del. Reclamation Project)	Operational	In-Vessel (Fairfield)	70
9. FLORIDA			
1. Brooksville	Design	In-Vessel (Bedminster Bioconversion)	
2. Collier County	Consideration	Windrow	
3. Cooper City Utilities	Operational	Windrow	(3.5 mgd)
4. Daytona Beach	Consideration		
5. Fernandina Beach	Operational	Windrow (Co-composting w/leaves)	
6. Fort Lauderdale	Operational	In-Vessel (Purac)	6
7. Gadsden Cty.: Florida State Hosp.	Operational	Windrow (Co-composting w/leaves)	
8. Hillsborough Cty. Utilities	Design	In-Vessel	35
9. Jacksonville: Buckman Plant	Operational	A-SP (Compost for odor filter)	2.25
10. Lee County	Consideration		
11. Loxahatchee River Dist.	Operational	A-SP	15
12. Manatee County Utilities	Operational	Windrow	3
13. Margate	Planning	Windrow	
14. Meadowood Utility	Operational	Windrow	4/month
15. Melbourne	Planning	In-Vessel (Fairfield)	20 wet tons/day
16. Orange County (at landfill)	Operational	Windrow	
17. Orlando	Consideration		
18. Palm Beach County	Planning	In-Vessel	40-50
19. Plant City	Operational	A-SP	±20
20. Reedy Creek	Operational	In-Vessel (Taulman)	6
21. Royal Palm Beach	Design (complete)	Windrow	8
22. Sarasota	Operational	In-Vessel (Purac)	12 wet tons/day
23. Univ. of Florida	Operational	Windrow	6-10
10. GEORGIA			
1. Northeast Clayton County WPCP	Operational	In-Vessel (Taulman)	1.6
11. HAWAII			
1. Waimanalo WWTP	Consideration	A-SP	17
12. IDAHO			
None			
13. ILLINOIS			
1. DuPage County Public Works	Operational	A-SP	6-8
14. INDIANA			
1. Bloomington: Blucher Poole WWTP	Operational	Windrow	2
2. Crawfordsville	Operational	Windrow	15/month
15. IOWA			
1. Davenport	Pilot	Windrow	30 (full-scale)
2. Des Moines	Consideration (Co-composting)		40,000 wet tons/yr.
3. Ft. Madison (Lee Cty.)	Operational	A-SP	15/week
16. KANSAS			
1. Mission	Consideration	Windrow & In-Vessel	20
2. Topeka: Oakland WWTP	Operational	Windrow	10-12
2. Wichita: WPCP #1 & #2	Operational	Windrow	10
17. KENTUCKY			
1. West Hickman Creek WWTP	Operational	A-SP	4.8-6
18. LOUISIANA			
None			
19. MAINE			
1. Bangor	Operational	A-SP	1964/yr.
2. Bar Harbor	Operational	A-SP	388/yr.
3. Gardiner	Operational	A-SP	1
4. Kennebunkport	Operational	A-SP	50/yr.
5. Kittery	Operational	A-SP	26/yr.
6. Lisbon	Pilot (in 1988)		1
7. Old Orchard Beach & Saco	Operational	A-SP	3234/yr.
8. Old Town	Operational	A-SP	24/wk.
9. Portland	Operational	A-SP	Small quantity
	Design (Complete)	In-Vessel (IPS)	16.2

Source: BioCycle, November/December 1988

SLUDGE COMPOSTING FACILITIES IN THE UNITED STATES—*CONTINUED*

STATE PLANT NAME	STATUS	TYPE	SLUDGE VOLUME dry tons/day (unless noted)
10. Scarborough	Operational	A-SP	.75
11. South Portland	Pilot	Windrow	
12. Yarmouth	Operational	A-SP	219/yr.
20. MARYLAND			
1. Aberdeen	Design	A-SP	1.6
2. Baltimore: Back River	Operational	In-Vessel (Paygro)	48.3
3. Cambridge	Operational	A-SP	300 cu. yd/month
4. Elkton	Operational	A-SP	2
5. Havre de Grace	Operational	Aerated Windrow	2-3
6. Montgomery County	Operational	A-SP	40
7. Perryville	Operational	A-SP	2.5
21. MASSACHUSETTS			
1. Amherst	Planning	In-Vessel	8
2. Barre	Construction	A-SP	5 yds./wk.
3. Berkshire County (Northern)	Consideration (Co-composting)		
4. Berkshire County (Southern)	Consideration (Co-composting)		30 wet tons/day (sludge & septage)
5. Billerica	Design (complete)	A-SP	5
6. Boston	Consideration	All options	120-125
7. Bridgewater	Construction	A-SP	3.5
8. Dartmouth	Design	In-Vessel	7,200 lbs./day
9. Deer Island (MWRA	Pilot	A-SP	3
Edgartown	Planning (& Pilot)	A-SP	1
11. Gloucester	Planning (by Agresource, Inc.)	A-SP	800/yr.
12. Haverhill	Design	In-Vessel	12-16
13. Hudson	Consideration	A-SP	60 wet tons/wk.
14. Leicester	Operational	A-SP	.26
15. Leominster	Design (complete)	A-SP	6
16. Marshfield	Operational	A-SP	145 yds/wk.
17. Marlboro	Construction	A-SP	12
18. Medford	Design	A-SP	3
19. Nantucket	Design	A-SP	3
20. Orleans	Construction	A-SP	3.8
21. Pepperell	Construction	A-SP	8 yds./wk.
22. Rockport	Planning (w/Gloucester)	A-SP	1
23. Somerset	Construction	A-SP	2.5
24. Southbridge	Operational	A-SP	16 cu. yd./day
25. Springfield	Planning	In-Vessel (Taulman)	8,800/yr.
26. Swampscott	Operational	A-SP	1.4/wk.
27. Westborough/Shrewsbury	Operational	A-SP	3
28. Williamstown/Clarksburg	Operational	A-SP	120 cu. yd./day
29. Yarmouth	Design (w/septage)	In-Vessel (agitated bin)	3
22. MICHIGAN			
1. Battle Creek	Consideration	In-Vessel (Taulman)	25
2. Mackinac Island	Operational	Windrow	
3. Trenton	Consideration	All options (inc. agitated bin)	2
23. MINNESOTA			
1. St. Paul (Southwest Area Regl. Mngt.)	Consideration	In-Vessel	40
24. MISSISSIPPI None			
25. MISSOURI			
1. Joplin Landfill	Pilot (Co-composting)		
26. MONTANA			
1. Missoula	Operational	A-SP (EKO-Compost)	5+
27. NEBRASKA			
1. Beatrice	Operational	Windrow	1.5
2. Grand Island	Operational	Windrow	7-10
3. Holdrege	Pilot	Windrow	.5
4. Kearney	Operational	Windrow	7/wk.
5. Omaha: Papillion Creek Plant	Operational	Windrow	1,200/yr.
28. NEVADA			
1. Clark County San. District	Design	Aerated Windrow	42
29. NEW HAMPSHIRE			
1. Bristol	Planning	A-SP	
2. Claremont	Operational	A-SP	2.2
3. Dover	Design	A-SP	5
4. Durham	Operational	A-SP	1.97
5. Hampton	Consideration	In-Vessel	800/yr.
6. Lebanon	Operational	A-SP	1.5
7. Merrimack	Operational (In-Vessel/Co-composting under consideration)	A-SP	21
8. Milford	Operational	A-SP	.75
9. Plymouth	Operational	A-SP (In-Vessel:IPS in design—2 dt/day)	.25
10. Sunapee	Operational	A-SP	
30. NEW JERSEY			
1. Buena Borough MUA	Operational	A-SP	3.5
2. Burlington County	Design (Co-composting)	In-Vessel (Horizontal bin)	30
3. Camden County MUA: Delaware No. 1 WPCF	Design	In-Vessel	35-40
4. Cape May County MUA	Operational	In-Vessel (Purac)	20
5. Manville Boro	Construction (complete)	A-SP	1.5
6. Middletown Township	Operational	A-SP	2
7. Musconetcong	Design	In-Vessel	3.5
8. Pennsville	Operational	Windrow	1
9. Rockaway Valley	Consideration	In-Vessel	5.5
10. Sussex County MUA	Operational	A-SP (Totally enclosed)	12
11. Warren County MUA (Pequest River)	Construction	A-SP	48
31. NEW MEXICO			
1. Albuquerque	Design	Aerated Windrow	15
32. NEW YORK			
1. Binghamton/Johnson	Construction	In-Vessel (Taulman)	10
2. Clinton County (Plattsburgh)	Operational	In-Vessel (Fairfield)	23-24
3. Endicott	Operational	In-Vessel (Taulman)	2
4. Guilderland	Operational	A-SP	1
5. Highland	Pilot	In-Vessel (Ag-Bag)	1
6. LeRoy	Consideration (Regional facility w/10 communities)	A-SP or In-Vessel	6
7. Lewiston	Consideration	In-Vessel	40 wet tons/wk.
8. Lloyd	Pilot	A-SP	
9. Lockport	Consideration		40+ wet tons/wk.
10. Monroe County	Consideration (Co-composting)	In-Vessel	100
11. Niagara Falls	Consideration		17
12. Rensselaer County (Eastern)	Consideration (Co-composting)		1 wet ton/day
13. Rockland County Sewer Dist. #1	Consideration	In-Vessel	4.5-5
14. Schenectady	Operational	In-Vessel (American Bio Tech)	15
15. Tompkins County	Pilot	A-SP	4 cu. yd./wk.
16. Tri-Municipal (Wappinger Falls & Poughkeepsie)	Operational	A-SP	2
17. Yorktown Heights	Operational	Windrow	1
33. NORTH CAROLINA			
1. Charlotte	Consideration	In-Vessel	30
2. Hickory, Newton, Conover & Catawba Counties	Construction	In-Vessel (Ashbrook-Simon-Hartley)	20
3. Morganton (Catawba River Plant)	Operational	A-SP	4.5
4. Raleigh	Planning	In-Vessel	20
5. Valdese	Operational	A-SP	1
34. NORTH DAKOTA None			
35. OHIO			
1. Akron	Operational	In-Vessel (Paygro)	73
2. Columbus	Operational	A-SP w/In-Vessel drying (Paygro)	18-30
3. Hamilton WWTP	Operational	In-Vessel (Ashbrook-Simon-Hartley)	17
4. Lake County	Operational	Aerated Windrow	7
36. OKLAHOMA			
1. Tulsa	Pilot	A-SP	
37. OREGON			
1. Newberg	Operational	In-Vessel (Ashbrook-Simon-Hartley)	3.5

SLUDGE COMPOSTING FACILITIES IN THE UNITED STATES—*CONTINUED*

STATE PLANT NAME	STATUS	TYPE	SLUDGE VOLUME dry tons/day (unless noted)
2. Portland	Operational	In-Vessel (Taulman)	30
38. PENNSYLVANIA			
1. Evans City (RBW Industries—Regional project)	Design	A-SP	50 wet tons/day
2. Lancaster	Operational	In-Vessel (Taulman)	32
3. Philadelphia	Operational	A-SP	300
4. Scranton	Operational	A-SP	18.2
5. [illegible]	Operational	A-SP	4
39. RHODE ISLAND			
1. Bristol	Planning		3
2. Jamestown	Operational	Windrow	330 cu. yd/yr.
3. South Kingston	Planning	In-Vessel	500 wet tons/year
4. West Warwick	Operational	A-SP	3-5
40. SOUTH CAROLINA			
1. East Richland County PSD: Gills Creek	Operational	In-Vessel (Taulman)	4-6
2. Myrtle Beach	Operational	A-SP	430/yr.
41. SOUTH DAKOTA None			
42. TENNESSEE			
1. Bristol	Bid Stage	In-Vessel	14.3
2. Nashville: Central Treatment Plant	Operational	A-SP	40
3. Nashville: Dry Creek	Operational	A-SP	5-6
43. TEXAS			
1. Austin	Operational	Windrow	10
2. Dallas	Pilot planned	In-Vessel	7-10 (30 at full-scale)
3. Fredericksburg	Operational	Windrow	
4. San Antonio	Operational (1/89)	Windrow	900 cu. yd./day
5. Trinity River Authority (Grand Prairie)	Design	Aerated Windrow	10
44. UTAH None			
45. VERMONT			
1. Bennington	Bid Stage	In-Vessel	2
2. Central Vermont Region (inc. Barre & Montpelier)	Consideration		10
3. Chittenden County Region (Burlington area)	Consideration		
4. Connecticut River Valley Region (inc. White River Junction & Brattleboro)	Consideration (Two towns may consider interim static pile composting)		15
5. Rutland Region	Consideration		15
46. VIRGINIA			
1. Hampton Roads San. District	Operational	A-SP	85
2. Henrico County	Construction	In-Vessel (Purac)	18
3. Moores Creek WWTP (Charlottesville)	Operational	A-SP	45-50/wk.
4. Upper Occoquan	Operational	Aerated Windrow	7.5
47. WASHINGTON			
1. Monroe	Operational	Windrow	
2. Seattle METRO	Operational	A-SP	10
3. Southwest Suburban Sewer District (Miller Creek & Salmon Creek)	Operational (by Northwest Cascade)	A-SP	3
48. WEST VIRGINIA None			
49. WISCONSIN			
1. Portage	Operational (Co-composting)	In-Vessel	2.4
50. WYOMING None			
51. DISTRICT OF COLUMBIA			
1. Blue Plains	Operational	A-SP	40
52. PUERTO RICO			
1. Arecibo	Construction	A-SP	15
2. Mayaguez	Construction	A-SP	74

SUMMARY COMPOSTING FACILITIES

OPERATIONAL:	
Aerated Static Pile	61
In-Vessel:	19
Windrow:	29
Aerated Windrow:	5
Vermicomposting	1
TOTAL OPERATIONAL:	115
UNDER CONSTRUCTION	
Aerated Static Pile:	10
In-Vessel:	4
TOTAL UNDER CONSTRUCTION:	14
PLANNING, DESIGN, BID:	
Aerated Static Pile:	13
In-Vessel:	20
Windrow:	3
Aerated Windrow:	3
Undecided:	1
TOTAL PLANNING, DESIGN, BID	40
PILOTS:	
Aerated Static Pile:	4
In-Vessel:	2
Windrow:	7
Undecided:	1
TOTAL PILOTS	14
CONSIDERATION:	
Aerated Static Pile:	3.5
In-Vessel:	14.0
Windrow:	1.5
Vermicomposting:	1
Undecided:	16
TOTAL UNDER CONSIDERATION:	36.0
SURVEY TOTALS:	
Operational:	115
Under Construction:	14
Planning, Design, Bid:	40
Pilots:	14
Consideration:	36
TOTAL:	219

1989 Solid Waste Composting Projects Summary (Tons/Day)

Name	Consider	Feasib.	Pilot	Design	Permit	Operation
Kenai Penin., AK	60					
Los Angeles Co., CA	X					
San Diego, CA	500					
Santa Barbara, CA			1			
Longmont, CO				300		
Pitkin Co., CO			30			
New Milford, CT					700	
Plainfield, CT					700	
Del. Rec. Proj., DE						350
Brooksville, FL					40	
Dade Co., FL					800	
Escambia Co., FL				400		
Jacksonville, FL		400				
Marion Co., FL		600				
Monroe Co., FL	550					
Okaloosa Co., FL	350					
Okeechobee Co., FL				100		
Pembroke Pines, FL				667		
Sumter Co., FL						120
Champaign Co., IL		300				
McHenry Co., IL	400					
Cherokee Co., IA	100					
Council Bluffs, IA					150	
Des Moines, IA					300	
Harden Co., IA					35	
Berkshire Co. (N), MA			107			
Berkshire Co. (S), MA		100				
Franklin Co., MA		300				
Lowell/Chem. Id, MA		377				
Nantucket, MA		100				
Northampton, MA		190				
Westfield, MA		178				
Mackinaw Isl., MI				26		
Albert Lea, MN			100			
Anoka Co., MN		280				
Scott/Carver Co., MN				300		
Crow Wing Co., MN				120		
E. Cent. SW Comm, MN				300		

1989 Solid Waste Composting Projects Summary (Tons/Day)

Name	Consider	Feasib.	Pilot	Design	Permit	Operation
Eden Prairie, MN				400		
Farmington, MN		20				
Fillmore Co., MN						25
Goodhue Co., MN		40				
Lk of Woods, MN						10
Prairieland, MN				200		
Rice Co., MN		100				
St. Cloud, MN						50
Steel Co., MN	100					
Swift Co., MN					20	
Wascea Co., MN	40					
Wash/Ramsey Co., MN		300				
Wright Co., MN				165		
Joplin Co., MO			300			
Scott Co., MO	X					
Kingston, NH				300		
Burlington Co., NJ				200		
Easthampton, NY		60				
Monroe Co., NY		X				
Rennselear Co., NY		100				
Southampton, NY	350					
Southold, NY				70		
Buncomb Co., NC		300				
Hamilton Co., OH	X					
Mercer Co., OH	50					
Montgomery Co., OH				200		
Portland, OR				600		
Lehigh Co., PA	850					
Big Sandy, TX						X
Hidalgo Co., TX					300	
Island Co., WA			20			
Skamania Co., WA						12
Morgantown, WV		20				
NW WI Planning Comm.		100				
Portage, WI						30
Ripon, WI		12				
COUNT	13	21	6	16	9	8
TOTAL TONS/DAY	3350	3877	558	4348	3045	597

TESTIMONY PRESENTED BY

MR. N.C. VASUKI, P.E.
GENERAL MANAGER
DELAWARE SOLID WASTE AUTHORITY
NOVEMBER 16, 1989
BEFORE THE SUBCOMMITTEE ON
DEPARTMENT OPERATIONS, RESEARCH AND FOREIGN AGRICULTURE
HOUSE COMMITTEE ON AGRICULTURE

Solid waste disposal has become a highly charged and emotional issue as we approach the third decade after "Earth Day - 1970." This demonstrates the Nation's continuing inability to look at the whole environment while we try to resolve our air and water pollution problems. We seem to transfer the pollution problem from one medium to another. We are also finding out that our reliance on land for ultimate disposal of all residues cannot be avoided.

The U.S.E.P.A. was created in the aftermath of the heady atmosphere of "Earth Day - 1970", ostensibly to manage the whole environment as contrasted with the fractured control which existed prior to its formation. The very fact you are holding this hearing demonstrates the failure of U.S.E.P.A. in operating a holistic control program. Current laws endow considerable powers and duties to that Agency. However, the Agency has been unable to make timely decisions on regulations and has, therefore, contributed to the crisis in solid waste and sewage sludge disposal. We sincerely hope that your Committee and other committees of the Congress will be able to reinstate the goal of managing the whole environment and redirect the Agency's attention to problem solving.

Your Committee is considering the need for a "pilot" project at the U.S.D.A. to develop and demonstrate viable technology for composting municipal waste and sewage sludge as a part of comprehensive waste management policies. In reality, the Federal Government has already provided a considerable amount of grants for such programs in the early seventies. The State of Delaware received a large grant - approximately $37 million for construction of a plant to demonstrate materials recovery and combined composting of MSW and sewage sludge. I am very proud to inform you that our plant is the only demonstration plant, among the many which were constructed, to remain in continuous commercial operation.

THE DELAWARE EXPERIENCE

The State of Delaware, although small and densely populated, has resolved its solid waste and sewage sludge disposal problem without resorting to ocean dumping or export to other states. In fact, it is our stated policy to dispose our wastes only in our backyard. Our pre-eminent position was achieved by starting a planning and implementation program in the mid-sixties.

The State of Delaware was one of the first states to recognize the need for an organized environmental protection program through the enactment of a series of laws starting in 1966.[1] In 1970, the State's General Assembly, in an unusual move, provided $1 million for research and development of technology to process municipal solid waste and recover materials for reuse. The State selected the Hercules Company for conducting such research and development, and the concept of the Delaware Reclamation Plant evolved. In 1972, the State responded to requests for proposals by the U.S.E.P.A. for research and development grants under Section 208 of P.L. 91-512. In 1973, the State of Delaware was awarded $9 million for its proposal to construct and operate the Delaware Reclamation Plant. The project also received $28 million from the Federal Water Pollution Control Act - Construction Grant Program.

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[1] (a) Water and Air Resources Act of 1966
(b) Delaware Environmental Protection Act of 1974
(c) Coastal Zone Act of 1971
(d) Wetlands Protection Act 1973
(e) Beach Preservation Act of 1972
(f) Delaware Solid Waste Authority Act of 1975

Our urban population in New Castle County produces daily two residues which are both difficult to dispose - municipal solid waste and municipal sewage sludge. The municipal solid waste can be broadly classified into three fractions: first, an unstable organic fraction - approximately 20-25% - (e.g. food wastes, yard wastes) which is easily susceptible to biodegradation; second, a stable organic fraction - approximately 45-50% - (e.g. paper, plastic, cardboard, etc.) which has been generally designed to defy quick biodegradation; and third, an inorganic fraction - 25-35% - which cannot be transformed through the biological degradation process. The first organic fraction is ideally suited for composting purposes. It contains materials which can be attacked by both bacteria (aerobic and anaerobic) and fungi to produce a stable humus-like material. The second organic fraction can best be converted to useful energy through incineration.. The inorganic fraction which contains many useful metals can be further processed to recover such metals for reuse. The residue from all of these processes must be disposed of in newly designed landfills.

Such rationale was used while designing The Delaware Reclamation Plant. Composting of solid waste was enhanced by combining sewage sludge in the process. The process used in the Delaware Reclamation Plant is the Fairfield-Hardy Aerobic Digester System. Our plant has a name plate capacity for processing annually 250,000 tons of MSW and 90,000 tons of dewatered (20% solids) sludge. The plant serves approximately 400,000 persons living in New Castle County, Delaware. During 1988, the plant processed 237,000 tons of MSW and 40,000 tons of sewage sludge. A complete report on this successful demonstration project has been provided to U.S.E.P.A.

After having commercially operated this plant for nearly five and one-half years, we are aware of the many problems. We have also learned to solve many of those problems. We can and do produce a high-quality compost suitable for varied horticultural, silvicultural and, to a limited extent, agricultural uses. We are also aware of several other composting technologies which can produce compost from MSW and sewage sludge. In fact, it is relatively quite easy to produce enormous quantities of compost.

Composting technology varies in scope between the very sophisticated Delaware Reclamation Plant and the very simple Windrow composting system developed, to some extent, by the U.S.

Department of Agriculture at Beltsville, Maryland, for sewage sludge. We have found operation and maintenance of composting plants to be complicated. They require much attention. There is always a potential for odor emanating from such plants; and, consequently, odor reduction or minimization becomes a very important factor. Technology for odor control is not readily available and requires almost a tailor-made, site-specific approach. Since there are no federal or state standards for odor, it becomes a subjective issue and one which is very difficult to resolve when the population near the plant is opposed to the plant.

Most states don't have standards for utilization of the compost and if they do, they may have differing requirements. Such differing requirements pose an invisible but extremely difficult barrier for interstate marketing of compost. Unless there is a federal overview and uniform federal standards for utilization of compost, individual states' bureaucracies severely retard marketing efforts of compost producers. State environmental protection agencies, in the absence of clear federal leadership, tend to become overly conservative. They develop extremely stringent requirements for compost utilization, and, therefore, create a questionable aura which does not help in marketing the compost.

The federal role in this area has become very important and clearly the inaction of the U.S.E.P.A. has created a problem for interstate marketing and utilization of compost. Since compost for agricultural or horticultural uses generally peak in spring and fall months, one must find other uses for compost during the summer and winter months. If not, one will have to develop large stockpiles of compost for distribution during the spring and summer months. An exceptionally wet Spring, like the one we have experienced on the East Coast in 1989, restricts the sale of compost. Since there are no federal labeling requirements or guidelines, marketing compost containing sludge becomes very difficult because the buyer wants to know whether the compost meets all federal requirements. In the absence of federal requirements, one has to indicate that the U.S.E.P.A. may adopt standards in the future which could result in the compost not being acceptable. Consequently, the potential user refuses to consider compost utilization because of regulatory uncertainty.

Experience in Delaware indicates that composting municipal solid waste from urban areas could pose a problem because of the presence of PCBs in the solid waste. Although PCBs have not been sold in the U.S. since 1972, those compounds are still circulating in the environment. The Delaware Reclamation Plant has the ability to test for PCBs, both in the solid waste and the sewage sludge, as well as the finished compost. Our data for the last three years indicates the presence of PCBs in the urban solid waste. The sources include fluorescent light ballasts, carbonless papers, ceiling tiles, and other materials which have been treated for fire retardancy. Although the presence of small quantities of PCBs does not prevent the marketing of the material, it does pose a problem for the producer while selling it to agricultural users. This was precisely the problem encountered by us.

Originally, when the Delaware Reclamation Plant was designed and constructed, a substantial portion of the compost (approximately 10-15 thousand tons per year) was earmarked for the broiler industry in the Delmarva Peninsula for use as litter in broiler houses. When we started testing the compost prior to its release to the market, we determined the presence of PCBs and, therefore, voluntarily withdrew the material from the market pending further testing. When continued testing showed the presence of PCBs, we abandoned that market and looked for other potential markets. Our most attractive market currently is for developing institutional lawns, highway median strips, the creation of topsoil by mixing the compost with poor-grade soil, horticultural applications for non-food plants in greenhouses, and as a substitute for topsoil in treating the sideslopes of landfills to vegetate such sideslopes.

Given this situation, we do not see the need for a "pilot" program envisaged by your Committee. Rather, we see an eminent need for the Federal Government to be involved in setting clear-cut standards for:

1. Compost Quality:
    (a) Organic and inorganic constituents.
    (b) Pathogen destruction criteria.

(c) Standard methods for determining pathogen levels in the field and in the crops.

2. Compost Utilization:

   Standards for Interstate transport and sale.

   Uniform Labels for composted materials.

3. Odor Criteria:

   Test Methods and procedures for resolving odor complaints.

The real problem is in the utilization and marketing of compost. As stated earlier, uniform federal standards would help raise interstate marketing barriers. The Federal Department of Transportation can substantially help by requiring federally supported highway construction projects to use compost for vegetating shoulders and median strips and embankments in lieu of stripping topsoil from farm lands. The effective use of compost in restoring vegetation at superfund clean up projects can be enhanced by providing immunity from future CERCLA Lawsuits when the supplied compost meets federally established standards.

If the invisible barriers for sale and movement of compost in the interstate market are not removed, then every community producing a compost will find itself inundated with the product with no real outlet except during spring and fall months. In such a case, compost will start piling up and will eventually create a problem of its own. If no assured markets are developed, the compost will have to end up on the landfill at some time, thereby, circumventing the very purpose of composting.

In behalf of the Board of Directors of DSWA, I thank you for giving us this opportunity to make our views known to you. We extend a cordial invitation to the Committee members and the staff of this Committee to visit our plant which is only an hour and one half by train from Washington. We will also be prepared to provide you with additional information if you so desire.

Testimony of

Michael H. Simpson

of Energy Systems Research Group

Definition:

For our purposes here today, composting should be defined as: a method of solid waste treatment in which the organic fraction of the waste stream is biologically decomposed under controlled conditions to a state in which it can be easily and safely handled, stored and applied to the land.

Constraints to Utilizing the Composting Option:

Between sixty-five and seventy percent of the municipal solid waste stream (MSW) is organic, and thus, could be degraded to a soil-like product utilizing composting methodology. However, the marginal costs for composting substantially increases a greater fraction of this waste stream is diverted to this option. The reason is that some wastes such as leaves and yard waste, agricultural wastes, and commercial/industrial organic wastes are already source separated. These wastes require very little complex equipment to process and thus, are relatively inexpensive to compost. To remove the organic fraction from non-source separated wastes, such as the residential waste stream, the pre-processing costs increase dramatically. This pre-processing consists primarily of separating the wastes and size reducing the particles.

Municipal solid waste composting, with or without sludge, will always be expensive. Nevertheless, compared to state of the art refuse-to-energy technology or those landfill operations which must meet best available control technology (BACT) for leachate and emissions control; municipal solid waste composting is competitive.

A second constraint is true of all recycling options. Compost must be of a quality that can be utilized. In this case, it must be land applied without negatively impacting the environment. With sludge and municipal solid waste composting, heavy metals and toxic organics may be an issue and should be addressed so as to protect the public's health as well as the environment. Developing appropriate land application guidelines/rules for MSW compost (which can be similar in nature to those governing sludge/septage land application) would be a good interim solution. For the long term, it is more important to keep those materials that negatively effect compost quality out of the waste stream in the first place. Thus, if municipal solid waste composting becomes a major solid waste management option in this country, a necessary corollary must be a dramatic increase in prior removal of household hazardous waste and industrial pre-treatment of waste waters. This latter point is particularly true when sludge is composted alone or with the MSW (co-composting).

To re-emphasize, if the compost can not be utilized, the composting process is not a viable solid waste management option. From a marketing standpoint, before a facility is sited or built, it is essential that the quality and quantity of the product coming from a composting operation be determined. The quality of the compost will determine potential end-uses. The higher the quality, the greater the possible uses for the product. Compost contaminated with metals and other toxics will have a decreased value and over time an increasingly constrained market potential. Over the long term, land application of this low quality material will undoubtedly degrade the basic systems in the soil environment.

MSW compost has a number of potential end-uses today. It can be utilized for major highway and public works projects. Similarly, it can be applied to forest lands. There is a great need for this type of material in land reclamation projects, eg. mine reclamation. This compost is ideally suited for landfill cover. These are just a few of the potential horticultural uses. To date, the major constraint to developing these end-uses or markets is the lack of consistent specifications. Both states and the federal government can play an active role by not only developing specification for utilization of compost in public sector projects, but also by giving a preference to compost over virgin soil or organic materials. States such as Minnesota, New Hampshire, Nebraska, and Massachusetts have attempted to utilize compost in public sector related projects. Thus, specification determination and appropriated end-use regulations are two areas of research/development which need to be instituted over the short term.

Composting As A Waste Management Option:

Traditional Disposal:

Burying organic wastes in landfills not only takes up valuable disposal space, but also removes a potential resource. In addition, burial of organic material leads to anaerobic degradation which contributes to both leachate and gas emission problems and associated costs at these disposal facilities. A related problem is deposition of a large quantity of organic material in a specific location within a landfill. Substantial differential settling and slumping of the surface can result, which in turn, could impact the integrity of a landfill cap.

Similarly, certain fractions of the MSW should not be burned. A recent paper concerning a refuse-to-energy facility in Massachusetts showed the heavy influx of wet organic material during the fall season not only negatively impacted emission control and ash generation rate, but also decreased revenues and increased costs. Other literature has pointed to potential increases in SO_x and NO_x emissions resulting from the burning of organic wastes such as yard waste. And as is true for landfilling, if these organic wastes were diverted from a refuse-to-energy facility, space would be made available on the tipping floor for more appropriate fractions of the MSW. This last point is particularly important in those areas which are currently in a disposal capacity shortfall crisis.

A recent survey by the National Solid Waste Manager's Association (NSWMA) has shown that disposal costs at landfills are up 32% over last year. At refuse-to-energy facilities the disposal costs have increased an average of 19%. In the New England region, tipping fees of $75 - $100/ton are quite common. These increased costs are the result of lost disposal capacity. This loss of disposal capacity through landfill closure is not being replaced due to local opposition to siting new landfills and refuse-to-energy facilities (NIMBY factor).

It is these high disposal costs which have given public decision makers, at both the local and state levels, an economic incentive to consider recycling and composting as viable waste diversion options. Through a realization of avoided disposal, and even avoided transportation costs, many areas of the country have seen a dramatic increase in composting.

Leaf & Yard Waste:

A recent *Biocycle* survey has shown for leaf and yard waste alone, over 650 municipal operations have sprung up around the country with the lead states being

New Jersey (185), Michigan (160), Massachusetts (140), and Pennsylvania (63). There are yard waste composting facilities in at least thirty states.

The total number of leaf and yard waste composting operations is only going to increase. New Jersey has banned leaves from disposal at landfills. Other state bans which are already legislated and scheduled to be initiated include: Connecticut (1991), and Pennsylvania (1990) for leaves; Illinois (1990), Florida (1992), and Wisconsin (1993) for leaves and yard wastes; Minnesota's deadline for leaves and yard waste is 1990 in the metropolitan region of St. Paul/Minneapolis and 1992 for the remainder of the state. Rhode Island is considering declaring leaves as "recyclable", which under Rhode Island law effectively bans this material from disposal within that state. Massachusetts is also in the process of seriously considering a ban on the material.

Leaf and yard waste composting is a relatively simple, low capital intensive process. This is primarily based on the fact that the material is usually source separated from the rest of the MSW. In addition, most communities find adequate uses for the compost within the municipal or regional boundaries. Though not fertilizer grade, this type of compost is an excellent soil amendment and provides an economic incentive by avoiding public sector soil purchase costs. Nor does leaf and yard wastes suffer from the potential of heavy metal and toxic organics contamination which could plague MSW and sludge composts.

Source Separated Commercial (Industrial) Organic Wastes:

Commercial organic wastes, or "Cows", offers many of the same advantages as the composting of leaves and yard wastes. The material is already source separated, of consistent quality and does not generally suffer from the contamination problems of MSW or sludge composting. In addition, the quantities of Cows are easier to estimate, which allows more accurate planning for construction of composting facilities, and reduces up-front planning costs. Finally, unlike leaves and yard wastes, the end-product resulting from the composting of Cows can not only serve as an excellent soil amendment, but also have a relatively high nutrient content.

In New England, Maine and Massachusetts have spearheaded efforts to utilize composting methodology to handle many different kinds of Cows. Successful projects, not only in New England, but across the country, have composted such materials as: potato wastes, apple wastes, fish by-products, wood wastes, paper mill wastes, wood by-products, sprouts, truck garden wastes, cranberry wastes, mushroom wastes, chocolate waste, beer wastes, meat rendering wastes, and a host of other food processing bi-products.

For many Cows, both the composting and environmental control methodologies are similar to those used for MSW and sludge composting. However, the high pre-processing costs are avoided and the need for post-processing blending required for end-use markets can often be avoided. Because of these factors, composting of Cows may often be the least cost waste management option when compared to landfilling or burning this fraction of the municipal solid waste stream. In essence, of all the uses for composting as a solid waste management tool, the composting of Cows has the greatest potential for growth and undoubtedly could be expeditiously implemented today in many states throughout the country.

Agricultural Composting:

The US Environmental Protection Agency in their 1989 report, "Nonpoint Sources: Agenda For The Future", identified agriculture sources of nonpoint source runoff. Cropland, rangeland and livestock operations have been identified as the major contributor of nonpoint source water quality problems. Agricultural nonpoint sources are estimated to be responsible for about fifty-seven percent of the nonpoint source pollutants to lakes and approximately sixty-four percent of the nonpoint source pollutants to rivers. These pollutants can result from poor manure management practices, improper application of fertilizers, herbicides, pesticides or fungicides, excessive erosion due to improper planting and harvesting techniques, or from nutrient depletion of the soil and subsequent increase in erosion.

As both a viable alternative to addressing the agricultural nonpoint source pollution and providing a means to enhance the economic viability of the farm operation, composting should be considered a priority not only by EPA but also by both SCS and ASCS in the Department of Agriculture.

Composting will produce a more appropriate material for land application than utilizing a method of direct application of raw manures. Compost, unlike farm wastes, will tend to release nutrients, such as nitrates, gradually. The result is avoidance of rapid nutrient leaching and subsequent impact to adjacent waters. In addition, if manures are composted, the problem of limiting land application to specific times of the year so as to avoid nonpoint source pollutants in surface run-off would no longer be of concern. For any one farm, if the compost operation has a throughput compatible with on-farm manure generation, waste storage, and the associated nonpoint source pollution and odor/fly problems from such storage, can be substantially reduced.

Because compost, unlike manures and/or commercial fertilizers, releases its nutrients over an extended period, the plant up-take of these nutrients can be more efficient. This could have an impact on reducing the need for subsequent fertilizer applications. It can also result in an increase to crop production; which in turn could mean reduced farm costs and increased revenue. An example of this was a four year research project in Minnesota which concluded that sixty percent of the compost plots yielded 16 bushels/acre better than comparison with commercial NPK fertilizer plots (120 bu/acre vs 104 bu/acre). For the other forty percent, little difference in yield (125.7 bu/acre vs 123.5 bu/acre) was found. Translated into dollars, eighty-nine percent of the compost plots returned an average of $29 more per acre than comparison commercial fertilizer NPK plots. The remaining eleven percent of all comparison plots favored commercial fertilizer treatment.

On-farm composting not only reduces the pollution risks associated with manure handling and fertilizer application, it also can reduce overall manure handling costs. A study by the New Alchemy Institute and the Massachusetts Department of Environmental Protection showed that when comparing traditional manure storage and land application techniques with a process of composting manures with waste paper and corrugated (cardboard), that composting was essentially a more cost effective handling method. The study looked at a 90 holstein dairy farm that generated 5 cubic yards of manure per day. Due to re-capitalization, first years costs for composting were in the red by $ 1,500 when compared to the traditional manure handling. But by year five, composting and subsequent land application saved $ 2,200 when compared to traditional manure handling. The projected savings by year ten was $ 9,000 from composting and land application of the manure.

This $ 9,000 figure is not an overwhelming cost savings, but in areas similar to New England, where the small farm is threatened, such a savings can be critical. Farmers also benefit by producing a product that can be sold and utilized off the farm. A number of small farms in the Northeast have begun to diversify their crops. As part of this effort, a number of farmers are turning to creating high fertilizer soil products through composting. As part of these agricultural composting strategies, some farmers have taken advantage of the present situation of disposal capacity shortfall. They have been contracting for specific fractions of the municipal waste stream. Thus, some farmers are getting paid to take what others consider a waste and they are turning around and selling the composted end-product. The types of organic MSW that farmers are taking is dry, relatively clean wastes that provide a good source of carbon. Leaves, newspaper, corrugated, sawdust, bark, wood shavings and straw all have been utilized in such composting operations.

For the size farms in New England, and the high costs of transportation, the market for compost is local. Farmers are getting anywhere from $50 a cubic yard to $3 to 4 per forty pound bag.

Another problem facing farmers is the Northeast and other areas of the country, results from increased population and subsequent urban/suburban sprawl. Farmers trying to maintain an operation in an area where they are surrounded by homes, condos, commercial centers, etc. are being barraged with complaints which often focus upon odor and/or flies. Both manure storage lagoons and manure piles can produce malodors due to the anaerobic conditions that are associated with these traditional manure handling methods. Composting can be utilized to reduce the potential for odor generation not only from storage but also during land application. Once cured, the compost can be stored indefinitely without fear of associated odor problems. Even wet stabilized compost does not give off offensive smells.

Similarly, the high temperatures attained during composting would destroy any fly larva that would normally be present in raw manure. The elevated temperatures also makes weed seeds unviable. As a result, composting can reduce the causes that fuel the neighbors' complaints. It seems likely that population growth and urbanization will continue to pressure the agricultural community, which in turn could have a direct impact on the long term survival of the farm in areas such as the Northeast.

Soil Erosion:

It is important to stress the fact that soil loss both in this country and worldwide is occurring at an accelerating rate. A study by the World Watch Institute based on data of the Soil Conservation Service, indicates the rate of excessive erosion approaches 1.7 billion tons per year. In essence, forty-four percent of US cropland is losing topsoil in excess of its soil loss tolerance level. This translates to .5 million hectares of cropland being abandoned per year because of severe erosion. Loss of this topsoil reduces productivity; for corn or wheat, research points to a six percent decrease in productivity per inch of topsoil lost.

Composting is one of the few strategies which can be implemented to mitigate this soil loss. Not only can compost contribute to the nutrient content of depleted soils; due to its high organic fraction, compost enhances soil aggregation, which in turn increases nutrient and water holding capacity. The direct result is both greater soil stability and enhanced plant growth, which will also contribute to soil conservation.

Finally, it must be remembered that composting is the quickest way to produce a soil product from raw organic material. If soil losses continue at the present rate, composting will not just be a choice, it may be a necessity.

Conclusion:

Due to the large organic fraction of the waste stream, and because of the depletion in disposal capacity, it seems likely that more of the municipal waste stream will need to composted. Source separated wastes: such as leaves and yard wastes, agricultural wastes and commercial/industrial organic wastes all lend themselves ideally to a composting waste management option. These wastes are relatively high quality and could undoubtedly be utilized for most agricultural/horticultural applications. In addition, the composting of much of these source separated wastes do not require large capital investments in pre-processing equipment. An additional objective may be to increase the residential/commercial waste stream diverted to composting operations by targeting the food waste fraction. If food wastes were to be capture from the residential/commercial sectors, a collection system , such as the "green bin" strategy used in Europe, would need to be instituted. To date, only a few communities have made a move towards separating out their food wastes from other residential wastes.

Municipal solid waste composting, with or without sludges, will continue to be a viable solid waste management option. However, regulations for MSW/Co-composting need to be developed, both for the process as well as for the end-use of the compost itself. As other federal, state and local efforts succeed in reducing the quantity and type of hazardous materials entering both the waste water and solid waste streams, MSW and sludge composting will continue to be more attractive. This requires that both household hazardous waste collection and industrial wastewater pre-treatment efforts be not only continued but increased.

The success of any composting alternative as a solid waste management option requires that the compost be utilized. Both nutrient levels in the compost as well as contaminants resulting from heavy metal or toxic organics, influence the potential end-use of this soil-like material. However, because of the solid waste crisis, the growth of the compost production may not be coupled with the growth of demand for this material. The federal government can take the lead, by first developing appropriate specifications for end-uses in which compost can be substituted for other soil amendment products. Secondly, with the development of these use specifications, procurement criteria developed by the federal government can be put in place so as to stimulate demand for these compost products.

Though, there are indications that the US Department of Agriculture is beginning to view composting as a viable alternative for farm operations. The Department's activities could be expanded upon. Both Soil Conservation Service and ASCS can increase their efforts in educating farmers to both the environmental and economic benefits of on-farm composting. Coupled with this grants monies should be allocated to stimulate efforts on the state and local level to expand the utilization of composting methods by farmers. Finally, these activities should be coordinated with EPA's efforts to remediate nonpoint source pollution from agricultural lands.

Respectively Submitted,

Michael H. Simpson

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Simpson, M., *Compost: A Different Approach to Marketing*, Conference on Developing and Enhancing Markets for Recyclable Materials, New York, NY, March 1989.

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USDA and EPA, *Manual for Composting Sewage Sludge by the Beltsville Aerated-Pile Method*, EPA--600/8-80-022, May 1980.

(Attachment follows:)

MICHAEL H. SIMPSON

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Energy Systems Research Group

EDUCATION

M.S.: Resource Management and Administration, Antioch/New England Graduate School, 1986.

M.A.: Liberal Studies: Science Emphasis, Dartmouth College, 1981.

B.A.: Biology and Philosophy, Denison University, 1975.

EXPERIENCE

1989-present	Energy Systems Research Group, Inc., Environmental Senior Scientist, and composting specialist.
1988 - 1989	E & A Environmental Consultants, Manager of Recycling and Leaf Composting Projects.
1986 - 1988	Massachusetts Division of Solid Waste Management, Director of Composting Programs.
1986	Normandeau Associates, Consultant. Coastal Mapping Project & Assessment of Impacted Wetlands in the Town of Rye, NH.
1984 - 1985	New Hampshire Resource Recovery Association, Assistant Director. Education programs, Technical Assistance, Strategic Planning, and Internal Relations.
1984-present	Antioch/New England Graduate School Faculty. Courses: Solid Waste Management, Environmental Dispute Resolution, Wetlands Resource Management.

SELECTED CONFERENCES AND PAPERS PRESENTED

Nov 1989	8th National Recycling Congress - Charlotte, NC *Integrating Leaf and Yard Waste Composting with Waste to Energy Facilities*
Sep 1989	The Environmental Impact on the Packaging Industry - Washington, DC *Sucessful Biodegradation of Bags: An Essential Requirement for Leaf and Yard Waste Composting*
Jul 1989	The ASTSWMO 1989 National Solid Waste Forum on Integrated Municipal Waste Management - Lake Buena Vista, FL *To Ban Or Not To Ban: Policy Decisions About Disposal of Leaf and Yard Waste*

Mar 1989	Conference on Developing and Enhancing Markets for Recyclable Materials - New York, NY *Compost; A Different Approach to Marketing*
Feb 1989	The Tennessee Recycling Conference - Nashville, TN *Backyard and Municipal Scale Yard Waste Composting; Both Necessary Parts of An Integrated Approach*
Jan 1989	The New York Solid Waste Management and Materials Policy Conference - New York, NY *Assessing the Environmental Impacts of Composting Yard Wastes*
Jul 1988	Missouri Waste Management Conference - Columbia, MO *Municipal Composting; Sludge and Yard Wastes*
Jun 1988	The New England Resource Recovery Conference - Portland, ME *An Economic Guide to Composting Alternatives for Solid Waste Management*
Apr 1988	The North American Recycling Conference - Toronto Ontario *Composting As A Solid Waste Management Tool*
Jan 1988	The New York Solid Waste Management and Materials Policy Conference - New York, NY *Integrated Solid Waste Management; The Massachusetts Approach To Composting*
May 1987	The National Biocycle Conference - Boston, MA *Municipal Scale Composting Projects*
Jan 1987	The Farm Composting Conference - University of Massachusetts, Amherst, MA *The Economics of On-Farm Composting*
Sep 1986	The North American Recycling Conference - Seattle, WA *A Regional Approach to Recycling for the Public Sector*

ESRG WORK PRODUCTS

1989	*Composting Operations Manual for Two Rhode Island Communities*, prepared for the Rhode Island Department of Economic Management. ESRG Project 89-128.
1989	*Notes for a Short Course on Municipal Scale Leaf and Yard Waste Composting for Rhode Island Communities*, Rhode Island Department of Environmental Management, and the Rhode Island Solid Waste Management Corporation. ESRG Project 89-128.

SELECTED OTHER WORK PRODUCTS

1989	*Notes for a Short Course on Municipal Scale Leaf and Yard Waste Composting for New Hampshire Communities*, developed for the state of New Hampshire.

1988 *Leaf and Yard Waste Composting Manual*, Engel,P; Simpson, M; an generic composting operations manual prepared for the National Corn Growers Association, for dissemination to local municipalities.

1988 *Operations Manual for Municipal Scale Leaf Composting (Draft)*, Massachusetts Division of Solid Waste, D.E.Q.E. An operations manual for municipal D P W and parks departments for the proper deposition, pre-processing, composting of leaves and yard waste.

1988 *Guidance for the Siting of Leaf and Yard Waste Composting Operations*, Dusalt, A; Marin, A; Simpson, M; Massachusetts Division of Solid Waste, D.E.Q.E. A document for municipal officials to plan and site a leaf and yard waste composting operation.

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1984 *Facts About Septage Disposal*, NH Resource Recovery Association Publication on the technical aspects of septage disposal options. Funded under an EPA 205j grant.

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1989 "Economic Overview of Agricultural Composting" *Recycling News* Vol 7, No. 3, p 5.

1989 "Composting Sludge and Septage: What Does the Future Hold For This Recovery Option?, Part 1" *Recycling News* Vol 7, No. 1, p 5.

1989 "Composting Sludge and Septage: What Does the Future Hold For This Recovery Option?, Part 2" *Recycling News* Vol 7, No. 2, p 5.

1988 "Leaf and Yard Waste Composting: Economic Overview" *Recycling News* Vol 6, No.4, p 5.

1988 "Leaf and Yard Waste Composting: The Planning Process" *Recycling News* Vol 6, No. 3, p 3.

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1 March 1990

The Honorable George E. Brown, Jr.
Chairman, U.S. House of Representatives
Committee on Agriculture
Subcommittee on Department Operations, Research,
and Foreign Agriculture
Room 1301, Longworth House Office Building
Washington, DC 20515

Dear Mr. Brown:

I should like to have this letter and attached material entered as testimony into the record of the 16 October 1989 Hearing on section 5 of HR 500.

I suggest that section 5 of this bill be revised as given later in this letter. This suggestion is based on the following.

1) Well-established scientific understanding of the cause and effect relationships which govern the behavior of the composting microbial ecosystem. This understanding comes from research and demonstration studies reported by many independent investigators in half a dozen different countries, as summarized in: Finstein, M.S., F.C. Miller, J.A. Hogan, P.F. Strom. 1987. "Analysis of EPA Guidance on Composting Sludge. Part II-Biological Process Control." *BioCycle* 28(2):42-47. A photo copy of this article is attached. Confirmatory studies are cited on page 44. More recent confirmations reported more recently include:

A.J. van Oostrom and R.N. Cooper. 1989. Composting primary sewage sludge by a temperature-controlled aerated static-pile method. *Proc. Water Pollut. Control Fed. Asia/Pacific Rim Conf.*, Honolulu, Hawaii, October 1989.

A.J. van Oostrom, R.N. Cooper and J.E. van Rossem. 1988. Temperature-controlled, aerated static-pile composting of slaughterhouse waste solids. In, *Alternative Waste Treatment Systems* (ed., R. Bhamidimarri). Elsevier Applied Science, p.174-184.

G. Vallini, A. Pera, F. Checchi, Maria Briglia and Franca Perghem. 1989. Compost detoxification of vegetable-tannery sludge. *Waste Management & Research* 7: 277-290.

2)Dramatic demonstration of the practical benefits of exploiting this scientific undrstanding, as represented by the conversion of the failed Sussex County (NJ) Municipal Utilities Authority composting facility to an EPA award winning one. This conversion is described in: Finstein, M.S., F.C. Miller, J.A. Hogan, P.F. Strom. 1987. "Analysis of EPA Guidance on Composting Sludge. Part IV-Facility Design and Operation. *BioCycle* 28(4):57-61; *and*, Flower, F.B. 1986. Sussex County Successfully Composts Sewage Sludge. Solid Waste Management Newsletter, *New Jersey Cooperative Extension Service*, 10(5):1-3.

The version of section 5 revised according to this suggestion follows.

....

SEC.5 WASTEWATER SLUDGE AND MUNICIPAL SOLID WASTE COMPOSTING
(a) IN GENERAL. -- Not later than 6 months after the date of the enactment of this Act the Secretary of Agriculture shall initiate a program to upgrade the process performance of the more than 150 existing "static pile" sludge composting facilities such as to maximize the rate of aerobic microbial activity at the expense of the waste, in order to minimizing capital and operating costs; and shall have developed a plan for taking advantage of the composting of sludge and suitable fractions of municipal solid waste.

(b) PROJECT REQUIREMENTS. -- The projects carried out under this section shall include
(1) the upgrading of process performance at existing sludge composting facilities, as in (a) above
(2) separation of hazardous/toxic materials from the municipal solod waste stream
(3) maximal separation of materials and their preparation for secondary materials markets
(4) composting of putrescible materials such as to maximize the rate of aerobic microbial activity at the expense of the waste, in order to minimise capital and operating costs; except that leaves in isolation from other waste might be a special case
(5) safe and environmentally sound use of thoroughly stabilized (nitrified) compost in horticultural practice
(6) best utilization of residuals/reject; but at least their environmentally sound disposition.

(c) REPORT. -- The Secretary of Agriculture shall submit a report to Congress not later than 1 year after the date of the enactment of this Act which lists those existing facilities upgraded and otherwise describes the results of projects carried out under this section.

……

I thank you for the opportunity to enter this testimony into the record. Please consider it on grounds of scientific/technical validity, and practical benefit in terms of minimizing construction and operating costs, and maximizing public acceptability.

Sincerely,

Melvin S. Finstein

Melvin S. Finstein, Ph.D.
Professor of Environmental Science

(Attachment follows:)

Heat Removal

Analysis of EPA Guidance on Composting Sludge

Part II—Biological Process Control

Problems occur when composting is viewed from a physical rather than a biological perspective.

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IN THE FIRST part of this series analyzing the most recent Environmental Protection Agency technical guidance publications on composting wastewater sludge, we focused on the interaction between the biological generation of heat, and temperature. This indicated that, unless prevented, the composting system tends to accumulate heat excessively, leading to temperatures which debilitate the biological community responsible for treatment. EPA guidance neglects this interaction. Part II herein focuses on the removal of heat to control temperature.

Ventilative Heat Removal To Control Temperature

Since the composting system tends to accumulate heat to the point of temperature-debilitation, rational (meaning that it is based on fundamental principles) process control hinges on deliberate heat removal to manage temperature. Formal analysis[9] confirms the intuitively obvious conclusion that ventilation affords the only practical means of removing heat in a controlled fashion. Moreover, the utility of ventilation in this application is indicated by the *air function ratio* [see Part I[1]]. This ratio ensures a generous supply of O_2.

An approach to process control based on the heat generation-temperature interaction, joined with ventilative heat removal in reference to temperature, was reported in 1980.[6-8] Yet ventilative heat removal was used in an empirical (trial-and-error) study reported in 1969, which demonstrated excellent process performance.[11] These observations became interpretable in fundamental terms with the 1980 development[9] which included a coherent conceptual framework of system dynamics. A preliminary interpretation of the earlier data[11] was reported in 1983.[12] This interpretation is expanded as part of the following discussion.

Elmco project. In the late 1960s, a pilot study of wastewater sludge composting was performed by the Eimco Corporation under contract to the U.S. Public Health Service (EPA was formed in 1971). The observations were published fully in a 1969 PHS report,[11] and a summary appeared a year later.[13] It transpired that temperature control by means of ventilative heat removal played a crucial role.

The study objective was to test the feasibility of composting sludge cake (vacuum-filtered primary and secondary sludges) without an external bulking agent, such as wood chips. Operation was based on semicontinuous feeding (8-10 hr/day) of a mixture of the sludges and recycled compost, in a plug flow pattern through a specially designed container (working volume, 44 ft^3). The calculated retention time (working volume/volume daily feed) was seven days, and the actual retention time (volume reduction during composting taken into account) was an estimated 26 days. The material was continuously agitated by paddles. Ventilation was provided continuously at a constant rate in the forced-pressure mode.

The operation could be sustained only if the recycled compost were sufficiently dry to absorb a large amount of excess moisture from the fresh sludge feed, thereby improving structure and porosity and decreasing stickiness (which interfered with agitation). It was therefore essential to vaporize large amounts of water during composting. This operational need was met through control of temperature such that ". . . the temperature of the mixed bed averaged about 140°F" (60°C). Judging from the representative data presented, it appears that most of the material experienced a daily temperature excursion from approximately 57 to 67°C.

That temperature control was realized to this extent, through the means employed, can be attributed to the confluence of three operational factors: semicontinuous feeding; a well-selected, though constant (time-invariant), rate of ventilation provided in the forced mode; and mixing by mechanical agitation. No doubt, time-variable ventilation via temperature feedback control (see next section) would have

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provided more precise control over composting temperature.

With the usual batch-type operation, ventilation at a constant rate generally leads to an inhibitively high peak temperature (e.g., 80°C). The Elmco arrangement differed, however, in that the feeding was semicontinuous. This tends to promote a semiconstant rate of heat generation, dampening out temperature variation against a constant rate of ventilative heat removal. Also, continuous mixing would contribute to the dampening effect. The perceived operational need was not primarily that of controlling temperature, but rather that of matching the feeding and ventilation regimens, such as to foster extensive moisture removal to provide dry recycle. Yet the means of effective moisture removal proved to be maintenance of an operational temperature of approximately 60°C.

Reliable operation and excellent process performance, as defined in specific objective terms, was demonstrated. Mass balance calculations based on the input and removal of material showed the following average reductions: volume, 73%; water, 87%; total wet weight, 73%; total dry solids, 30%; volatile solids, 47%. Also, pathogen destruction was extensive.

In reporting the study,[11,12] cause-and-effect relationships were not extensively explored. The interpretative emphasis with respect to ventilation was on the removal of moisture rather than heat. This reflects an operational bias, and the extreme operational difficulty represented by the high water content of sludge.

A variant of the air function ratio was developed[11] in noting that much more air was needed for drying than for maintaining an oxygenated state. Though true, the idea in this form is not fruitful. The ratio for drying is highly variable depending mainly on sludge moisture content and inlet and outlet air conditions, and has been estimated to range from 10 to 40.[16] More fundamentally, this variant leads away from the idea of exploiting ventilation for temperature control. In contrast, the air function ratio (amount of air needed to remove heat/amount needed to supply O_2), indicates the practicality of doing so, because this ratio (approximately 9:1) automatically ensures plentiful O_2 when the focus of process control is temperature.

This incomplete interpretative development does not detract from the significance of the findings.[11] These clearly demonstrated a new, practical approach to sludge composting which was effective in terms of objectively defined sludge treatment goals. Moreover, the need for external bulking agent (e.g., wood chips) was avoided. This work was overshadowed, however, by the Beltsville method as first announced in the mid-1970s.[13-16]

The Elmco work[11,12] is not cited in the EPA guidance publications being analyzed.[14] It is similarly overlooked in 12 related EPA publications [for the list see Part I[1]]. Though in one[17] a derivative summary[18] of the report[11] is cited in passing. The report[11] is cited in a U. S. Department of Agriculture publication,[19] but only to classify the Elmco test facility as an example of a "mechanical process." Thus, the approach represented by this highly significant, timely federal (U.S. PHS) report,[11] published in 1969, was bypassed during the formative period of sludge composting practice.

Rutgers strategy. In the late 1970s field studies on sludge composting were conducted in Camden, New Jersey, by several groups at Rutgers University under common contract to EPA. One group's plan was to develop a process control strategy based explicitly on the heat generation-temperature interaction, with the operational objective of restricting the temperature ascent to a maximum of 60°C. Implementation was in batch configuration without mechanical agitation or enclosure, thereby preserving the structural and operational simplicity originally motivating the Beltsville method. A deliberate approach to biological process control was employed, however, as manifested in the arrangement for ventilation. This was to actuate the blower via temperature feedback control to match ventilative heat removal to its generation, poising temperature at the desired maximum. Only the forced pressure mode of ventilation was used, as it proved superior to vacuum induction. This approach came to be termed the *Rutgers strategy.*[5-8]

The material composted was primary wastewater sludge mixed with wood chip bulking agent. A later study demonstrated that wood chips could be replaced with recycled compost.[20,21]

The initial field tests involved 16 7-ton piles and one 20-ton pile. The results were reported to the EPA and subsidiary sponsors in 1980[6] and in published papers starting in 1980.[5-10,22-25] At this point the following were established:

- Temperature feedback control of a blower can effectively maintain an operational ceiling of <60°C in batch composting of a primary sludge, without mechanical agitation. Typically the temperature sensor was positioned approximately 2 feet above the point of air inlet in a 7-foot high pile, with a set-point of 45°C (blower actuated at higher temperatures).
- Blower capacity must suffice to meet peak demand for heat removal. For the mixture of primary sludge (volatile solids content, 75%) and wood chips tested, peak demand was approximately 3,700 cubic feet per hour (cfh) per wet ton of the sludge-wood chip mixture. This is roughly equivalent to 30,000 cfh/dry ton sludge.
- Back pressure was typically 2 inches of water head, permitting the use of cost-effective radial blade blowers; forced-pressure ventilation proved superior to the vacuum-induced mode.
- In a typical trial the level of O_2 in the interstitial atmosphere was usually >15%, the moisture content of the mixture decreased from an initial level of 75% to 23% in 15 days, and the odor quality improved rapidly judging from odor panel evaluations of samples [discussed in Part III[3]].
- During this 15-day period total rainfall was 5.1 inches. Because of the strong drying tendency this caused only superficial wetting.

These observations formed the basis of a coherent theory of composting process dynamics which accounts for key interactions among heat generation, temperature, ventilation, and vaporization.

The theory predicts and explains various aspects of system behavior, such as the following: a sharp temperature increase that occurred when blower operation was interrupted during a period of high demand; an observed relationship between the assigned temperature set-point and demand for blower operation; the comparative strength of the drying tendency at different set-points; the dwindling of demand in response to a depletion of microbially available water and/or substrate; a revival of demand with rewetting. The centerpiece of both the process control strategy and the theory of system dynamics is the interaction between heat generation and temperature.

Subsequent Developments. This field work was continued without interruption under a second EPA contract, and a draft final report describing the second phase was submitted in 1982. The final project report was published by EPA 32 months later in 1985.[26] The following studies were described in this report and in papers commencing in 1982.[6,21,26-33]

- A side-by-side comparison between the Rutgers strategy and Beltsville method involving two 40-ton piles.
- Use of recycled compost as bulking agent instead of wood chips (note absence of mechanical agitation).
- A theory of composting process dynamics, previously expressed qualita-

tively,[1-8] was reduced to five mathematical equations.

- A comparative study of the curing stage, including odor panel evaluations, involving material initially composted by the two approaches.
- A comparison of biologically driven drying and non-biological air-drying, based on field observations and theoretical considerations.
- A demonstration of deliberately induced harsh terminal temperature for the purpose of ensuring pathogen destruction, without significant penalty to other treatment functions.
- A mathematical model for providing uniform distribution of air.

The basic principles represented by the Rutgers strategy were confirmed in independent studies performed by other University groups, as follows.

- The strategy was implemented using a mixture of wastewater sludge and refuse.[31]
- The strategy was demonstrated in routine use at a large facility using various mixtures of sludge and bulking agents.[32]
- The heat generation-temperature interaction was demonstrated to be operative at a large facility, through use of radiolabeled substrates.[33]

A logical progression can thus be traced from the demonstration of the heat generation-temperature interaction in the early 1940s and 1960s,[3] to the empirical yet highly successful approach to process control reported in 1969,[11] to the deliberate use of ventilative heat removal, as dictated by the interaction, first reported in 1980,[5,6] to various more recent confirmations and elaborations of these developments.

EPA Guidance

The position of EPA, as represented by 16 guidance publications spanning 1974 to 1985 (1-4; see Reference 5 for complete list) lies outside of the logical progression outlined above. The basic problem is a lack of appreciation of the biological nature of the process and a related lack of any serious consideration of temperature control. This is analyzed below for the four most recent publications.

1979 Guidance Publication.[1] The closest approach to a discussion of heat removal and temperature control in this publication is as follows:

> Increasing the oxygen concentration beyond 15 percent by air addition will result in a temperature decrease because of the greater air flow.

The statement correctly describes any composting system, exemplified by the Beltsville method, in which temperature has ascended to a debilitative level. Microbial heat generation by a debilitated community cannot keep up with increased ventilative removal. Near-exclusive concern for ventilation's O₂ supplying and moisture removal functions and neglect of its heat removal function, led to faulty analysis. This highly consequential error was avoidable through appreciation of the biological nature of the process in general, and the interaction between biological heat generation and temperature in particular.

1980 Guidance Publication.[2] With respect to heat removal and temperature control, the following passage is illustrative:

> Proper control of the aeration rate is essential because too high a rate can lead to excessive heat loss, cooling of the pile and incomplete stabilization.

The comments above concerning reference 1 pertain equally to this passage.

1981 Guidance Publication.[3] With respect to heat removal and temperature control, this publication's position was already noted [see Part I[5]].

1985 Guidance Publication, chapter 1.[4] An important section of this chapter concerns ventilation. Regarding the mode of blower operation, the following is recommended:

> One advantage [of the vacuum-induced mode] is that any odors are funneled into a point source and can therefore be more readily controlled [by discharge through a scrubber pile]. . . . Generally, a suction [vacuum] mode should be maintained for the first 8 to 14 days of composting until the odors generated during the initial composting phase have diminished . . . . Then the blowers should be reversed to provide positive [forced-pressure] aeration, which will accelerate the drying of the compost.

The deleted material, which is distracting here, relates to pathogen destruction [discussed in Part III[5]].

Despite the statement about excessively high temperature in the footnote to Table 1.14 of this guidance publication [see Part I[5]], the above passage is inconsistent with the idea of controlling temperature. Note that the inefficient vacuum mode[1,2] is recommended for the first part of the primary stage, just when heat removal is most needed to control temperature. Also it is implied that the scrubber pile [original rationale for the use of the vacuum-induced mode[5]] is effective in removing odors. Aside from earlier indications of scrubber pile ineffectiveness and the need to address the problem of odor at its source,[5,6] in Chapter 2 the scrubber pile is declared to be "essentially cosmetic."[4]

As in the earlier guidance publications,[1-3] moisture removal is viewed basically as an exercise in nonbiological air-drying. The problem is compounded in offering the following guidance for the sizing of blowers:

> From a biological point of view, the microorganisms need only about 5 grams (gm) of oxygen per gm of drying solids to stabilize the material. Drying, however, requires approximately 9 to 10 times more air.

This is the variant of the air function ratio noted earlier to be nonfruitful (see *Elmco project*). As was indicated, this variant diverts attention from the heat removal function of ventilation and the practicality of controlling temperature. In the present case the diversion takes the form of the following assertion:

> . . . whatever electrical power is theoretically needed to maintain the necessary oxygen supply during composting should be quadrupled to ensure that larger blowers can be accommodated later if necessary.

"Theoretically" is not explained, and in fact no theoretical approach for judging power needs is available. The power needed to meet the peak demand for ventilation as exerted by a particular sludge, when composted under biologically favorable conditions (temperature-controlled), can be determined only through appropriate testing of the sludge in question.

Later in the chapter, work based on the Beltsville method [or minor variant thereof[5]] in Camden, New Jersey, is cited in noting that the air requirement might be as much as 1,500 cfh/dry ton sludge. How the value of 1,500 was arrived at is not clear. Regardless, this is approximately 4x that of the original Beltsville prescription[3] and appears to be the basis of the "quadrupled" statement in the above passage. This is only 5%, however, of the observed *peak* demand of approximately 30,000 cfh/dry ton of (Camden) primary sludge,[5,6] as noted earlier (see *Rutgers strategy*).

Fundamentally, consideration of blower sizing is logical only in the context of controlling temperature to prevent biological self-debilitation. Hence, the consideration should be based on heat removal in reference to temperature, bearing in mind that, given this approach, the air function ratio ensures excess O₂. Owing to the time-variable nature of heat generation, implementation necessarily involves blower control via temperature feedback. The basic datum needed is the peak demand exerted by the particular sludge (see above). In the absence of this datum, 30,000 cfh/dry ton sludge is a usable conservative value based on an energy-rich primary sludge (probably leads to overdesign). These considerations, essential for meaningful sizing of blowers, are absent from Chapter.[4]

1985 Guidance Publication, chapter 2.[4] This chapter concerns sludge composting at three facilities in the state of Maryland, located at Western Branch, Dickerson, and "Site II" at Silver Spring. These facilities, owned and operated by the Washington Suburban Sanitary Commission, are among the biggest of their type ever constructed. The one at Western Branch, designed according to the Beltsville model,[7] was forced to close in 1981 owing to public complaints about odor. Because of public pressure, operation at Dickerson was permitted only on a temporary basis for two years, terminating at the end of 1982. During this period nuisance odors were generated. The Dickerson facility was also based on the Beltsville model, but during its lifetime numerous modifications were tried in anticipation of Site II:

> ". . . Dickerson was essentially an extension of the Beltsville research."[4]

Like the original work, this extension treated composting as a physical process, neglecting its biological nature.

This neglect is apparent in the approach taken to odor control, which was the overriding concern at Site II:

> "One major incentive for perfecting the Site II aeration system was to minimize odor generation."[8]

From a microbial perspective, odor control is seen as an outcome of rapid aerobic decomposition, and this is one of the reasons to focus on the problem of maximizing the rate of activity. Like its predecessors, however, at Site II the approach was focused on removal of odors from the outlet air by discharging it through a pile of cured compost. This not only misdirects effort to the problem's symptom rather than its cause, but worsens the problem at its source in that the filter contributes to back pressure (resistance to airflow), decreasing the possibility of effective temperature control. Excessive back pressure emerged as a severe problem at Site II.

Site II was designed to receive 400 wet tons (80 dry tons) of sludge cake per day. Initial construction cost was ". . . More than $30 million . . ." with subsequent additional expenditure of ". . . about $4 million in efforts to control odor. . . ."[10]

Operationally, the sludge is mixed with wood chips and formed into extended piles to a height of 12.5 feet for 21 days of composting.[4,38-40] Air was drawn through the composting piles (vacuum-induced mode) and discharged, via manifold and header ductwork, through a central filter pile. This arrangement greatly increased the power requirement:

> Fifteen-horsepower blowers, as opposed to the 1-hp blowers at Dickerson, were necessary to supply the increased aeration required by the system. The need for greater aeration was due to the central filter pile arrangement. By having all the blowers discharge into one filter pile, substantial back pressure—up to 28 inches (71 cm) of water—is created, and the back pressure increases the power requirements for aeration.

Compared with the 28 inches of water back pressure experienced at Site II, the original Beltsville method (pile height 8-12 feet, small decentralized filter piles, 1/3-hp blowers) generates less than 5 inches.[3] This high back pressure is a symptom of an inferior design at Site II relative to the already troubled Beltsville model.

Despite the powerful blowers a prestart-up test indicated that the high back pressure interfered with aeration:

> These tests indicated that back pressure in the manifold varied considerably as the various blowers that discharged into it were turned on and off. The variation in back pressure in turn affected aeration rates. The solution to this problem was to install a temperature controller [temperature feedback control] that caused the blower to stay on until the temperature in the pile center fell below a specific temperature. The aeration rates were thus made independent of the back pressure.

This seems to indicate that the system was retrofitted with temperature feedback control devices to solve the problem of excessive back pressure, which is illogical.

The passage continues in a vein suggestive of a more understandable reason for the retrofit:

> It was also hoped that temperature optimization would result in more thorough drying and a more stable material after 21 days. Further tests were run with temperature controllers in place, and on the basis of these results, temperature controllers were permanently installed at Site II.

In the absence of any contrary indication, this gives the incorrect impression that the first application of temperature feedback in controlling the composting process was at Site II. This misimpression is similarly given in an earlier journalistic report[40] and in a recent paper by Site II personnel.[41] In fact, the important development represented by temperature feedback control of a blower for deliberate ventilative heat removal apparently was first reported in 1980 as an essential physical element of the Rutgers strategy.[6,12]

Other problems with the passage include the implication that simply installing the equipment for temperature feedback control leads *ipso facto* to temperature optimization. (No definition of optimization was offered.) In fact, such equipment is a necessary but not a sufficient condition for effective temperature control. A necessary corollary is sufficient ventilation capacity to meet *peak* demand. At Site II, maximum delivery is 4,500 cfh/dry ton sludge and does not suffice to control temperature effectively.[41] The relatively small air delivery at Site II, despite a large power input (56 15-hp blowers), reflects the excessive back pressure. In turn, a component of this problem is the use of the vacuum-induced mode.

Insight into the status of O_2 within the composting mass at Site II is provided by certain data on the exhaust gas.[4,41] The following compounds were identified as major malodorous products: hydrogen sulfide, methanthiol (methyl mercaptan), methyl disulfide, methylsulfide, and sulfur dioxide. Except for sulfur dioxide, these gases are strongly associated with anaerobic conditions. A known mechanism for the oxidation of hydrogen sulfide might account for the sulfur dioxide anomaly,[42] but this possibility cannot be independently evaluated for lack of published analytical detail.

A variety of other process modifications were made at Site II suggestive of continuing difficulties. The curing stage pad was fitted with blowers because the post-21-day material was prone to generate malodor. It was concluded that the scrubber pile was "essentially cosmetic," and attempts were made to pre-scrub the outlet air by fitting the header with spray nozzles. Neither a water nor a hydrogen peroxide spray was effective. Atomization of the hydrogen peroxide was planned. Ultimately, the scrubber pile was abandoned, and spray solutions containing hydrochloric acid, sulfuric acid, and sodium hypochlorite were tried.[38] Based on independent reports of October 1985[39] and July 1986,[43] Site II was still a source of nuisance odor.

Since excessive moisture was a continuing problem, providing a rain cover for more of the pad area was being considered.[4] In an effort to remove more moisture, piles were torn down and restacked by front-end loader. This constitutes a partial reversion to windrowing, and as such is another indication of persistent inadequate ventilation by blower. Ironically, development of the Beltsville method (basic model for Site II) was motivated by the need to replace windrowing because of odor nuisances associated with this type of composting.[15-18,40-42]

In a special comparative test, forced pressure was reported not to remove more moisture than vacuum.[4] This was offered as evidence contradicting a comparative study of the Rutgers strategy and Beltsville method.[20] The test described appears to have involved solely direction of ventilation as the experimental variable, whereas in the research cited[20] fundamentally different strategies for managing the composting system were compared (direction of ventilation was only one aspect of the experimental design). Thus, the two studies[4,20] are not comparable. In a notable omission from the guidance publication,[4] it is not mentioned that the cited research[20] was based on temperature feedback control.

The problems at Site II are not merely those usual to operational start-up. Rather, they are attributable to the scaling-up of a fundamentally unsound model.

The problem of odor is discussed methodically in part III of this series.[7] Meanwhile, it should be noted that the problems at Site II led the Maryland State Legislature to pass an odor control law aimed specifically at sludge composting facilities.[40] A statement appearing in July 1986 concerning ". . . somewhat extraordinary efforts [at Site II] to refine the static aerated pile process for maximum odor control"[41] reflects a continuing failure to appreciate the biological basis of composting. Similarly, assertions appearing in April 1985 that Site II has ". . . been quite a success"[39] and in June 1985 that it is ". . . a well designed . . . facility . . ."[40] have no basis in reality. Site II represents a series of confused and chaotic attempts to recover from the uncorrected misconception that composting is a physical process.

Summary Conclusions

EPA guidance lacks an appreciation of the effect of temperature on the composting microbial community and resultant process performance. Similarly lacking is an appreciation of the benefits of controlled ventilative heat removal, such that temperature is poised at biologically favorable levels. The problematic Site II facility (Silver Spring, Maryland) represents the outcome of guidance which views composting from a physical rather than biological, perspective.

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